Vol. 31 July, 1937 727 No. 1

QUARTERLY

OF THE

National Fire Protection Association

Subscriptions to the QUARTERLY are accepted only as a part of the general publications of the Association which are sent to members. Associate membership is open to anyone interested; annual dues $10.

Entered as second-class matter December 15, 1928, at the Post Office at Boston, Mass., under act of March 3, 1879.

60 BATTERYMARCH STREET, BOSTON, MASS.

National Fire Protection Association

INTERNATIONAL

Executive Office, 60 Batterymarch Street, Boston, Mass., U. S. A.

OFFICERS

GEORGE W. ELLIOTT, PRESIDENT
SAMUEL D. McCOMB, VICE PRESIDENT
A. R. SMALL, VICE PRESIDENT
ALBERT T. BELL, CHAIRMAN BOARD OF DIRECTORS

FRANKLIN H. WENTWORTH, MANAGING DIRECTOR
PERCY BUGBEE, ASSISTANT MANAGING DIRECTOR
ROBERT S. MOULTON, TECHNICAL SECRETARY

Organization Members

American Institute of Architects.
American Institute of Electrical Engineers.
Air Conditioning Manufacturers Association.
American Association of Port Authorities.
American Boiler Manufacturers Association and Affiliated Industries.
American Gas Association.
American Marine Insurance Syndicates.
American Oil Burner Association, Inc.
American Petroleum Institute.
American Transit Association.
American Water Works Association.
Arizona Equitable Rating Office.
Arkansas Fire Prevention Bureau.
Asphalt Shingle and Roofing Institute.
Associated Factory Mutual Fire Insurance Co's., Inspection Department.
Associated Lumber Mutual Fire Insurance Companies.
Association of Canadian Fire Marshals.
Association of Edison Illuminating Companies.
Association of the Fire Alarm Industry.
Association of Fire Underwriters of Baltimore City.
Association of Mill and Elevator Mutual Insurance Companies.
Association of Mutual Fire Insurance Engineers.
Board of Fire Underwriters of the Pacific.
Board of Fire Underwriters of the Territory of Hawaii.
Board of Underwriters of New York.
Boston Board of Fire Underwriters, Inc.
British Columbia Insurance Underwriters Association, Fire Branch.
Bureau of Explosives.
Canadian Automatic Sprinkler Association.
Canadian Manufacturers' Association.
Canadian Underwriters' Association.
Cast Iron Pipe Research Association.
Cellulose Plastics Manufacturers' Association.
Central Station Fire Protection Association.
Central Traction and Lighting Bureau.
Chemical Fire Extinguisher Association, Inc.
Chicago Board of Underwriters.
Chlorine Institute, Inc.
Clay Products Association.
Compressed Gas Manufacturers' Association.
Cotton Insurance Association.
Diesel Engine Manufacturers' Association.
Eastern Underwriters Association.
Eastern Underwriters Inspection Bureau.
Edison Electric Institute.
Factory Insurance Association.
Factory Mutual Laboratories.
Federation of Mutual Fire Insurance Companies.
Fire Insurance Rating Bureau (Wis.).
Fire Underwriters Inspection Bureau (Minn., N. D., S. D.).
Idaho Surveying and Rating Bureau.
Illinois Fire Prevention Association.
Illinois Inspection Bureau.
Improved Risk Mutuals.
Indiana Inspection Bureau.
Institute of Makers of Explosives.
Insurance Association of Providence.
International Acetylene Association.
International Association of Electrical Inspectors.
International Association of Fire Fighters.
International Brotherhood of Electrical Workers.
Iowa Insurance Service Bureau.
Kansas Inspection Bureau.
Kentucky Actuarial Bureau.
Lightning Rod Manufacturers' Association.
Louisiana Rating and Fire Prevention Bureau.
Manufacturing Chemists' Association of the United States.
Michigan Inspection Bureau.
Middle Department Rating Association.
Mississippi State Rating Bureau.
Missouri Inspection Bureau.
Motion Picture Producers and Distributors of America, Inc.
Motor Fire Apparatus Manufacturers' Association, Inc.
Mountain States Inspection Bureau.
Mutual Fire Inspection Bureau.
Mutual Fire Insurance Association.
National Association of Air Filter Manufacturers.
National Association of Credit Men.
National Association of Engine and Boat Manufacturers, Inc.
National Association of Fan Manufacturers.
National Association of Insurance Agents.
National Association of Mutual Insurance Companies.
National Automatic Sprinkler Association.
National Board of Fire Underwriters.
National Clean Up and Paint Up Campaign Bureau.
National Electrical Contractors Association.
National Electrical Manufacturers' Association.
National Lumber Manufacturers' Association.
National Municipal Signal Association.
National Paint, Varnish and Lacquer Association.
Nebraska Inspection Bureau.
New Brunswick Board of Fire Underwriters.
New England Insurance Exchange.
Newfoundland Board of Fire Underwriters.
New Hampshire Board of Underwriters.
New Jersey Schedule Rating Office.
New York Board of Fire Underwriters.
New York Fire Insurance Rating Organization.
Nova Scotia Board of Fire Underwriters.
Ohio Inspection Bureau.
Oil Insurance Association.
Oklahoma Inspection Bureau.
Oregon Insurance Rating Bureau.
Pacific Coast Building Officials' Conference.
Pacific Factory Insurance Association.
Railroad Insurance Association.
Railway Fire Protection Association.
Rigid Steel Conduit Association.
Safe Manufacturers National Association.
Society of Motion Picture Engineers.
South-Eastern Underwriters' Association.
Tennessee Inspection Bureau.
Terminal Elevator Grain Merchants' Association.
Texas Inspection Bureau.
Texas State Fire Insurance Department.
Underwriters' Association of the District of Columbia.
Underwriters' Laboratories, Inc.
Underwriters Service Association.
Virginia Insurance Rating Bureau.
Washington Surveying and Rating Bureau.
Western Actuarial Bureau (Fire).
Western Canada Insurance Underwriters' Association.
Western Factory Insurance Association.
Western Sprinkled Risk Association.
Western Underwriters Association.
West Virginia Fire Underwriters' Association.
West Virginia Inspection Bureau.

Printed in U. S. A.

Table of Contents.

HOTEL LOCH ARBOUR FIRE ..... FRONTISPIECE

EDITORIALS 5

MEETINGS OF BOARD OF DIRECTORS 9

PROGRESS AGAINST ARSON. *Percy Bugbee* 14

RURAL FIRE PROTECTION IN CALIFORNIA. *Loren S. Bush* 16

THE 1936 FIRE LOSS 24

U. S. LOSSES LOWER FOR FIRST PART OF 1937 28

CANADIAN FIRE LOSSES, 1936 28

STATISTICS OF FIRES IN CANADIAN AND FOREIGN CITIES, 1936 29

RATS, MICE, AND MATCHES 30

KANSAS GASOLINE TRUCK ORDINANCE UPHELD 32

VIENNA FIRE DEPARTMENT MODERNIZED. *Boris Laiming* 38

WINNIPEG FIRE PREVENTION PROGRESS 44

COMPANY FINANCED LIGHTNING RODS. *E. S. Craig* 45

FLAMMABLE LIQUID STORAGE IN FLOOD AREAS 47

HINDENBURG FIRE, LAKEHURST 53

PHILADELPHIA WATERFRONT FIRE 56

KRAUSE MILLING CO. EXPLOSION AND FIRE 59

OMAHA EXPOSITION FIRE. *Nebraska Inspection Bureau* 67

HOTEL LOCH ARBOUR FIRE 69

LAURIER GARAGE EXPLOSIONS, MONTREAL 71

FIRE RECORD OF DAIRIES AND CREAMERIES 73

FIRES IN WHICH THERE WAS LOSS OF LIFE 81

Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Wide World.

Dramatic view of the $150,000 fire which quickly swept the Hotel Loch Arbour on May 17, 1937. Fortunately it had not been opened for the summer season and no lives were lost. **(See story on page 69.)**

The Quarterly

Vol. 31 July, 1937 No. 1

The 1937 Meeting in Retrospect. The rapid pace of events at the 41st annual meeting of the Association held in Chicago last month so absorbed the attention of the members and delegates that they perhaps sensed the full significance of the convention only when viewing the meeting in retrospect. The Proceedings of the meeting, printed as Part 2 of this QUARTERLY, contain a complete record, but cannot fully reflect the spirit that pervaded the gathering, the inspiration of President's Elliott's forceful personality, nor the other intangible factors that made the meeting so interesting and worth while for all who attended.

The meeting far eclipsed previous annual gatherings in the interest shown by members. For the first time in the history of the Association the sessions extended through five days. The registration of 825 was the second largest in the annals of the Association, but the actual attendance in the convention hall during the sessions was a record — nearly double that of the average of recent years. The increased attendance may have been due in part to the central location in Chicago, in part to improvement in business conditions, in part to the whole-hearted welcome of our Chicago hosts, but above all to increasing participation in the affairs of the N.F.P.A. by important groups that have not previously been represented to any great extent at our annual meetings. Particularly noteworthy is the increased participation by fire department officers and men, as well as state fire marshals and other public officials who are in a position to utilize the findings of the Association in their daily work. Fire department members now constitute about twenty-five per cent of the Association membership. Nearly a hundred men from this group were present in Chicago. This number appears doubly significant when it is realized that most of these men have to pay their own expenses, because many municipalities, pressed for funds, find it easier to deny all traveling expenses than to differentiate between junket conventions and worthwhile gatherings such as ours.

These new groups have not yet been participating in the affairs of the Association long enough to make their influence fully felt, but as their activity in N.F.P.A. affairs is extended, their influence may be expected to be increasingly important, as it should be to round out the development of the N.F.P.A. as an organization representing all groups and reflecting all shades of opinion in the continuing campaign against loss of life and property by fire.

The Fire Marshals Section Meeting. The session of the Fire Marshals Section, despite the competition of other simultaneous group meetings, was itself a more largely attended session than many of the general gatherings of the Association in past years. The papers presented and the general discussions reflected a vitality, a breadth of interest, and a sincerity of purpose that should be a revelation to anyone who may have questioned the effectiveness of state, provincial or municipal officers engaged in this work. Despite the handicap of politics the fire marshals have in many instances accomplished remarkable results. The state officers are peculiarly subject to political interference; a change in state government administration generally means a change in the office of fire marshal. The fire marshal's job is regarded as a political plum, to be given to some political friend who has rendered conspicuous service. Curiously enough, while theoretically wrong in the case of a technical and specialized position, this system has put into the fire marshal's office some men of real ability who have rendered conspicuous service. The explanation perhaps is that it is only the man of more than ordinary ability that is capable of rendering such political service as to secure this reward, and that when once in office the importance and value of the work are so obvious to the man of intelligence that as soon as he understands the opportunities for service, he enters upon his new work with energy and enthusiasm. However, as in any field of effort, frequent change in personnel is undesirable. Full effectiveness comes only with experience, and the fire marshals who have had the advantage of long experience have a conspicuous advantage. The meetings of the Fire Marshals Section are thus of great value in enriching the experience of the men who attend, and providing through personal contact with other men in the same work a breadth of view and intimate knowledge of the technical and psychological aspects of the work that are immensely valuable.

* * * * *

N.F.P.A. Standards in Law. The fire marshals and other public officials are increasingly realizing the value of N.F.P.A. regulations as the basis of laws or ordinances, or better still, of regulations having the force of law. The N.F.P.A. technical committees, with the valuable review and approval by the entire Association in annual convention, provide an amount of technical talent and practical experience that is not available to the average state or municipality without prohibitive expense and wasteful duplication of effort. Furthermore, the N.F.P.A. method of developing standards is designed to consult the interests of all those concerned, so that the desired objective of reasonable safety from fire may be achieved without unnecessary hardship or expense. For this reason the N.F.P.A. standards are largely used as a basis of public safety regulations, and the recent tendency, constitutional limitations permitting, is to adopt them by reference, often in

such a manner that the adoption of a revised standard by the N.F.P.A. almost automatically puts it into effect with the force of law in many places.

This use of N.F.P.A. standards, supplementing their earlier use as advisory codes of good practice, enhances their importance, and makes them of increasing interest to various groups. N.F.P.A. committee meetings, and the annual N.F.P.A. meetings at which the standards are adopted, still maintain their character as assemblies of disinterested members acting in the public interest, and are relatively free from the political log rolling, bloc voting, and domination by selfish minorities that are characteristic of many legislative assemblies. At the recent meeting in Chicago there were at least two standards before the convention, both of a controversial nature, that would automatically become law upon adoption by the Association. It reflects great credit upon the Association that both of these were discussed fairly and dispassionately, with full consideration of the minority views. But the events at Chicago showed, to those who followed the subjects closely, that the present high character of the Association standards can be maintained only through the consistent interest and attention of the rank and file of the Association's membership, who have no axe to grind and who are unselfishly working to advance the Association's aims and to promote the cause of fire safety.

* * * * *

The Marine Section Meeting. Simultaneous with the Fire Marshals Section and other meetings, the Fourth Annual Meeting of the Marine Section in Chicago had an attendance which was very significant for such a gathering so far from seaboard cities. The Marine Section, continuing the activities of the former Marine Committee, operates with little publicity but remarkable effectiveness in applying to vessels the principles of fire prevention and fire protection that have been previously established by the Association in its standards for land structures. Unlike the protection of land structures which is a matter of local regulation, the safeguarding of vessels is to a considerable extent covered by Federal government laws and regulations. The findings of the Marine Section, universally recognized as the most authoritative guide to fire safety, have accordingly been in many cases translated into Federal regulations, where they are applied with the force of law. The Section has in this way rendered a major service in improved safety to life and property from fire at sea. This service, however, is appreciated by only a small group, for the general public sees only the government requirements and has no knowledge of the prior activities of the N.F.P.A. in this field. This method of operation thus adds little to the renown of the Association, but is in nowise inconsistent with the traditional policy of the N.F.P.A. whose members have always contributed whole-heartedly to our work in the public interest, without thought of personal glory.

Trailers and Trailer Camps. Typical of the Association's policy of giving prompt consideration to all developments that may involve new fire problems was the round table discussion of automobile trailers and trailer camps at the Chicago meeting. The discussion brought out the complexities of the trailer situation and the new and unusual aspects of well-known fire hazards presented by this new phase of modern civilization. With characteristic desire to make its contribution to the control of the fire hazard aspects of every new problem, the meeting asked the Board of Directors to create a new committee on this subject. At a subsequent meeting the Board took this action and by the time of the next annual meeting it is expected that this new committee will present a report pointing the way towards the most effective method of safeguarding the fire hazards of trailers and trailer camps. The problem, to be sure, is only in part a fire problem; health and sanitation, taxation, and various social questions are also of major importance. The function of the N.F.P.A. will be to make its contribution in the fire field, and leave to other agencies the study of other aspects of the problem.

* * * * *

Fire Protection Results. It is characteristic of fire protection that only the failures are spectacular and attract public notice. The successes are largely unrecognized, for it is difficult to evaluate and publicize the large fires that do not occur. For this reason it is particularly gratifying to receive specific recognition of the effectiveness of fire protection recommended by the N.F.P.A. The following letter from Mr. Harry L. Mead, Architect, of Grand Rapids, Michigan, speaks for itself:

In 1925 your Association, by the furnishing of data and information concerning the effect of fires in institutions, assisted the writer very materially in the successful promotion of the installation of a system of automatic sprinklers in St. John's Home, an orphanage in this city.

This is a very large four story and basement structure of the older type of construction with open stairways and was considered by the authorities of our fire department and others as a serious hazard.

The system was installed in due time and has with the exception of a small amount repaid its cost in the saving of insurance premiums through the ensuing years and nothing else happened until now.

At one o'clock A.M. on June 23, a fire broke out in an old couch, probably due to spontaneous combustion, and ignited the floor and woodwork in the building, and it is with great satisfaction that we are able to announce to you that within the space of a very few minutes 125 children and some 18 or 20 attendants left the building in the most orderly manner and upon arrival of the fire department companies, it was found that the sprinklers had extinguished the fire.

What the result of this fire not extinguished in its incipiency might have been is of course only speculation. As it is, everyone is happy and we wish you to share in our satisfaction.

Yours sincerely,

(Signed) HARRY L. MEAD, President,
The Advisory Council of St. John's Home
Grand Rapids, Mich.

Indirect Causes. In its compilations of fire statistics the Department of Fire Record has many puzzling questions to decide. Continually in the study of loss of life fires arises the problem of what to do with pneumonia deaths as the aftermath of fire, how to classify drownings, falls, traffic accidents, strokes at fires, and many other indirect fire fatalities. It has been the policy of the Department of Fire Record to include these in its studies where the facts are properly authenticated. Recently, however, a report came to the executive office which raised the problem once again.

A police officer made a heroic rescue at a fire of three years ago. In mental and physical ill health from the burns he received, he was given a leave of absence which he spent in a sanitarium for mental cases. When he left, supposedly cured, he went to live with his brother, a physician. Then, three years from the date of the fire, he went completely insane and shot his brother, a nurse and her brother, and himself, all fatally.

Meetings of Board of Directors.

Chicago, May 10, 1937.

Present.

Albert T. Bell, Chairman
George W. Elliott, President
S. D. McComb, Vice-President
Harold L. Miner, Past-President
Sumner Rhoades, Past-President
Franklin H. Wentworth, Managing Director

W. F. Hickey
C. W. Johnson
A. H. Kehoe
F. T. Moses
C. W. Pierce
D. J. Price
A. R. Small
R. E. Vernor
J. L. Wilds

Business Transacted.

1. A resolution on the death of Vice-President C. H. Haupt was unanimously adopted.

2. The following associations were elected to organization membership:
   (a) International Association of Electrical Inspectors
   (b) Association of Mutual Fire Insurance Engineers

3. The selection of E. R. Hardy as Chairman of the New York City Committees was approved.

4. H. E. C. Rainey of Washington was elected Chairman of the Membership Committee.

5. The Chairman was authorized to select a new Technical Advisory Committee of the Board, and subsequently appointed Messrs. C. W. Pierce (Chairman), George W. Elliott, S. D. McComb, Harold L. Miner, Frederick T. Moses.

6. The report of the Treasurer to the annual meeting was approved.

7. The report of the Chairman to the annual meeting was approved.

8. It was voted to hold the summer meeting of the Board in Boston on Monday, June 21.

Boston, June 21, 1937.

Present.

Albert T. Bell, Chairman
George W. Elliott, President
A. R. Small, Vice-President
Harold L. Miner, Past President
Franklin H. Wentworth, Managing Director

H. T. Cartlidge
A. O. Dawson
Hovey T. Freeman
Russell Grinnell
C. W. Johnson
A. H. Kehoe
W. E. Mallalieu
F. T. Moses
S. L. Nicholson
C. W. Pierce
D. J. Price
D. V. Stroop
John L. Wilds

There were also present Percy Bugbee, Assistant Managing Director, and Robert S. Moulton, Technical Secretary.

Business Transacted.

1. The following members were elected officers of the Corporation for the year 1937-1938:

President—George W. Elliott
Vice-President—Samuel D. McComb
Vice-President—A. R. Small
Secretary-Treasurer and Managing Director—Franklin H. Wentworth
Chairman, Board of Directors—Albert T. Bell

2. The Advisory Committee 1937-1938 was appointed to consist of Albert T. Bell, Chairman, Geo. W. Elliott, Samuel D. McComb, A. R. Small and C. W. Pierce.

3. Messrs. A. O. Dawson and David J. Price were selected to complete the Nominating Committee for 1938.

4. The recommendations in the address of the President were referred to the Managing Director for conference with the Executive Office Staff and the preparation of a memorandum for discussion by the Board at its next meeting.

5. It was voted to ask member Charles H. Fischer for suggestions as to creation of the Technical Division recommended by him at the annual meeting, for consideration and report to the Board by the Committee on Technical Procedure.

6. It was voted to hold the 42nd annual meeting in Atlantic City during the week of May 9, 1938.

7. The following Program Committee was appointed: The President, the Managing Director, the Chairman of the Board of Directors; with authority to add to their number.

8. The Budget submitted by the Treasurer was approved after amendment restoring the salary of the Electrical Field Engineer beginning July 1, 1937, to the rate of his compensation before its reduction in 1932.

9. On motion of the Chairman of the Electrical Committee, it was voted to adopt the amended text for the 1937 edition of the National Electrical Code as approved by letter ballot of the Electrical Committee in accordance with the authorization of the annual meeting. This action included approval of amendments to Article 500 of the Code, reinserting the reference to pyroxylin plastic manufacturing plants in the Note following Par. 5005, and reinserting following Par. 5024 the Note which appeared after Par. 3203, of the 1935 edition, as referred to the Electrical Committee for further consideration by action of the annual meeting.

It was further voted that the Executive Office be authorized to submit the 1937 edition of the Code to the American Standards Association for approval as an American Standard and to certify the new edition to the National Board of Fire Underwriters for publication.

10. It was voted to empower the Committee on Technical Committee Procedure to act in the name of the Board on the approval of an interim revision in the National Electrical Code proposed for inclusion in the 1937 edition, and relative to sub-paragraph 4 of paragraph a of Section 2371 thereof, subject to the favorable outcome of the letter ballot of the Electrical Committee.

11. A resolution from the International Association of Electrical Inspectors recommending an increased representation upon the Electrical Committee of those concerned with the public interest and authorities legally enforcing the National Electrical Code was discussed, together with communications from the National Municipal Signal Association, Inc., endorsing the resolution. Dr. Morton G. Lloyd and Mr. Wm. H. Greenlaw, members of the Electrical Committee, appeared as representatives of the above organization members in support of the resolution, and a telegram from the U. S. Conference of Mayors endorsing the same was received and read. A committee consisting of Past President Harold L. Miner as Chairman, and David J. Price, Charles W. Johnson and President George W. Elliott ex-officio as members was appointed to give full consideration to the matter and report their findings and recommendations to the Board through the Advisory Committee.

12. On recommendation of the Committee on Blower Systems, changes in the Regulations for the Installation of Air Conditioning, Warm Air Heating or Cooling and Ventilating Systems and in the Regulations for the Installa-

tion of Air Conditioning and Ventilating Systems in Other Than Residences were approved. [The text of these changes as recommended by the committee appears in the discussion of the report of the Committee on Blower Systems at the 1937 annual meeting (see Proceedings, 1937, page 303) with the addition of authority to revise Figure 1 by removing from the illustration the ducts passing through the first floor without protection, which was reported by the committee as an error and inconsistent with the text of the regulations.]

It was further voted to authorize the Executive Office to submit the above standards, and the 1937 edition of the Regulations for the Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal to the American Standards Association, under the proprietary sponsorship procedure, as a complete revision of the Regulations on Blower and Exhaust Systems approved by the A.S.A. as an American Standard, January 31, 1935.

13. On recommendation of the Committee on Gases, editorial changes in the 1937 report of the committee were approved. (These changes, purely editorial in intent, have been incorporated in the text of the report as printed in the 1937 Proceedings.)

14. On recommendation of the Committee on Farm Fire Protection, a revision of Division V of the 1937 committee report on the subject of Fire Protective Construction on the Farm was approved as follows:

Under the heading Barns and Outbuildings, amend the tenth paragraph, dealing with lighting systems, to read as follows:

"Similarly, the installation of electric or other lighting systems should conform to the regulations promulgated by the National Fire Protection Association for installations in such buildings. On premises where a continuous underground metallic water-piping system is not available as a grounding electrode and where it is not practicable otherwise to secure a ground of permanently low resistance, the use of an electric wiring method which does not employ metal enclosures for the wires is recommended. Where lanterns are used, substantial safe hooks should be provided in locations convenient for the work to be done, but free from the risk of igniting flammable substances.

15. On recommendation of the Committee on Building Construction, a change in the 1937 report of the committee was approved, with editorial amendment by the Board, as follows:

Under the heading Magnesite Flooring, fourth paragraph, second sentence, change "necessary" to "advisable" and replace the fifth paragraph with the words "Depending upon the type of surface desired, the cost installed varies from relatively low to relatively high."

16. In accordance with action of the annual meeting, it was voted to create a technical committee on Automobile Trailers and Trailer Camps, the personnel to be selected by the Executive Office subject to the approval of the Committee on Technical Committee Procedure and subsequent confirmation by the Board.

17. In accordance with the action of the annual meeting, the Executive Office was authorized to include in the next printing of the Flammable Liquids

Ordinance an additional appendix on Recommended Safeguards and Safe Practices for the Protection of Tanks containing Flammable Liquids in Flooded Regions. (The text of these recommendations appears in this QUARTERLY, page 49.)

18. In accordance with action of the annual meeting on recommendation of the Chairman of the Committee on Piers and Wharves, the Committee on Laws and Ordinances was instructed to develop a recommended ordinance on the construction and protection of piers and wharves, based on the existing N.F.P.A. recommended good practice standard on this subject, including such requirements thereform as in the opinion of the Committee on Laws and Ordinances may be appropriately applied in a municipal ordinance.

19. The list of proposed committee appointments, recommended by the Committee on Technical Committee Procedure, was confirmed. (The revised personnel will be shown in the 1937 Year Book.)

20. The report of the Committee on Technical Committee Procedure was approved, including action on the following recommendations of the committee.

Authorization to act on matters of committee personnel prior to the publication of the 1937 Year Book, subject to confirmation by the Board.

Approval of the policy of the committee in limiting committee appointments to representatives of organization members of the Association, individual associate members especially qualified to serve, and representatives of the United States and Canadian governments; also the application of this policy to N.F.P.A. committees operating under A.S.A. sectional committee procedure. This action was based upon the recommendation of the Committee that organizations or individuals desiring to serve on N.F.P.A. technical committees should be sufficiently interested to contribute to the overhead of committee administration by the nominal amount of N.F.P.A. dues and the fact that the N.F.P.A. technical committee procedure offers through subcommittees, conference committees, or other forms of partial participation, ample opportunity for non-members to present their views without the necessity of having voting representatives on N.F.P.A. committees.

Approval of power to the Electrical Committee to authorize the National Electrical Contractors Association to designate three alternates for each of its two voting representatives on the Electrical Committee. This action was based on special considerations outlined by the Chairman of the Electrical Committee and is not intended as a general precedent.

Approval of the view that a scope statement for the Electrical Committee now under consideration by the Committee on Technical Committee Procedure, may appropriately be broader than the scope statement for the National Electrical Code, thus permitting the Electrical Committee, if desired, to consider matters beyond the present scope of the Code.

21. A communication from the Motion Picture Producers and Distributors of America concerning differences between certain motion picture film regulations and requirements of the National Electrical Code was referred to the Committee on Technical Committee Procedure for conference with the Chairmen of the Electrical Committee and the Committee on Hazardous Chemicals and Explosives.

Progress Against Arson.

By Percy Bugbee.

The Fire Marshals Association of North America organized a committee in 1919 to survey the arson situation and to prepare a model arson law. This committee found that the laws at the time were extremely varied and there was an almost total lack of uniformity among the states. They found that in only two states, namely, New Jersey and Georgia, did the state laws recognize the principle that the burning of one's own property was just as hazardous to life and to the property of neighbors and just as much arson as the burning of property of another.

As a result of the work of the committee, the model arson law was prepared. It was kept very simple in character and each of the various degrees of arson was clearly defined and proper penalties for each degree clearly stated. The principles of this model arson law can be very easily stated. Arson in the first degree is the burning of a dwelling house and the penalty is not less than two nor more than twenty years. Arson in the second degree is the burning of buildings other than dwellings and the penalty here is not less than one nor more than ten years. Arson in the third degree is the burning of other personal property, such as automobiles, haystacks, etc., and the penalty is not less than one nor more than three years. Arson in the fourth degree is the preparing of a building to commit arson, and a definition of what an attempt to burn is, is clearly stated and included in the law. The penalty here is not less than one nor more than two years, or a fine not to exceed $1000. The final section of the model arson law is devoted to the person who burns property with intent to defraud an insurance company. The penalty is not less than one nor more than five years. Persons who hire someone else to burn or who participate in any way in the commission of the crime are just as guilty under the model law as the actual "torch."

The provisions of this law which were already embodied in the laws in New Jersey and Georgia were clearly desirable and had been tested and upheld in the courts of those states. It was not until 1926, however, when the Fire Marshals Association of North America decided to affiliate with the National Fire Protection Association that a real campaign for the adoption of this model legislation was instituted jointly by the fire marshals, the National Fire Protection Association and the arson division of the National Board of Fire Underwriters. The success of this joint campaign which has persisted up to the present time has been little short of phenomenal. In 1927, the first year of the campaign, the provisions of the model arson law were adopted in Alabama, Indiana, Iowa, Michigan, New Hampshire, North

Carolina, New Mexico, Rhode Island and Tennessee. In 1928 South Carolina, Kentucky and Louisiana adopted the law. In 1929, the most successful year of the entire campaign, the law was adopted in thirteen states, namely: Arkansas, Arizona, California, Delaware, Illinois, Maryland, Missouri, North Dakota, Ohio, Pennsylvania, South Dakota, West Virginia and Wisconsin. In 1931, Utah, Texas, and Florida were added to the list and in 1932 Massachusetts, Mississippi and Virginia fell in line. In 1933 the model arson law was adopted in Colorado. In 1935 Connecticut, Kansas, Nebraska, Vermont and Wyoming joined their sister states. In 1936 the great State of New York amended its arson statutes to include the provisions on attempts to burn and now has in effect all of the provisions of the model arson law except that the penalties in New York State are more severe. Oregon has amended its arson statutes during the 1937 session of its legislature to include provisions of the model arson law. This leaves only the states of Idaho, Maine, Minnesota, Montana, Nevada, Oklahoma and Washington, and there appears to be little doubt that in course of the next few years these states will also fall into line and we will have a uniform arson law in operation throughout the entire country. Many organizations and individuals throughout the states have coöperated in the campaign for the adoption of the law, but the direction of the campaign on a national scale has continued to be handled by the three groups originally joining together in 1926 for the purpose.

Following the adoption of the model law by the various states, with the consequent increase in effectiveness in the work of the state fire marshals in controlling arson, the next step was to build up an adequate procedure for the prompt and thorough investigation of fires by city fire department men and by the creation of local arson squads of specially trained fire and police investigators for this work. These developments have been taking place slowly but persistently and today the good-sized city that does not have a local arson squad of some sort is the exception rather than the rule. Important factors in creating this desirable development have been the emphasis on arson investigation and procedure in the various firemen's training schools throughout the country and the activities of the various state fire marshals in furnishing trained arson investigators in the smaller communities and rural districts where full time local men are not available.

The next major problem in the campaign for adequate control of arson which faces the country is the more active coöperation of prosecuting attorneys. Arson cases have in the past been looked at with disfavor by prosecuting officials because of the general feeling that it was difficult if not impossible to secure convictions. Evidence in arson cases is practically always circumstantial in character. Where prosecuting officials have taken sympathetic and active interest in arson prosecutions, good results are usually obtained and it is the practice now in a number of the larger cities to assign a member of the

prosecuting attorney's staff full time to this special work. The widespread adoption of the model arson law and the more intelligent investigation of fires by fire officials is bringing about very definitely a change in public sentiment towards arson, and once the prosecuting officials realize that the chances of success in arson cases are much greater under present conditions than formerly progress in stamping out this crime will be materially accelerated.

The man who deliberately fires a building is just as cold-blooded a criminal as the gangster or hired murderer. He knows full well that his deliberately set fire may spread and bring with it heavy loss of life and property. The community has no place for this sort of individual and public sentiment is very definitely against the incendiary. Much progress has been made, but much progress can still be made through an ever-widening circle of coöperative action against this most serious crime.

Rural Fire Protection in California.

By Loren S. Bush,
Board of Fire Underwriters of the Pacific.
(Member N.F.P.A.).

It has been estimated that over one-third of the area of California, excluding deserts and National Forests, is covered by fire protection. There are more than two hundred rural fire trucks in operation. Of the fifty-eight counties in the state, eight are wholly protected and twenty-five others have partial protection. This is a long step from the situation only ten years ago when practically no protection was available in the rural areas. It is a longer step to our ultimate goal of having all burnable property in the state under some form of fire protection.

Like most programs of fire protection and prevention, the rural protection of California was stimulated by a number of serious fires occurring during the summer of 1928.

Early Fire Apparatus.

Prior to that time, there were some fire-conscious farmers who had equipped water barrels with hand pumps and spray hose and mounted them on skids which could be readily transferred to a truck. A later development was to mount this equipment on a trailer and provide a can for wet sacks. Other communities provided trailers with a battery of 2½-gallon extinguishers and a few of these are still to be found doing active service. To those who initiated this crude form of protection should go much of the credit for sub-

---

This article was presented as a paper at the 41st Annual Meeting of the National Fire Protection Association, Chicago, May 10-14, 1937. For discussion see Proceedings (printed as Part 2 of this QUARTERLY) page 448.

sequent developments. The first tank truck was built about 1923. It consisted of a large oil tank, and a small pump operated by an unreliable two-cycle engine mounted on the running-board. The truck was seriously overloaded and had other undesirable features.

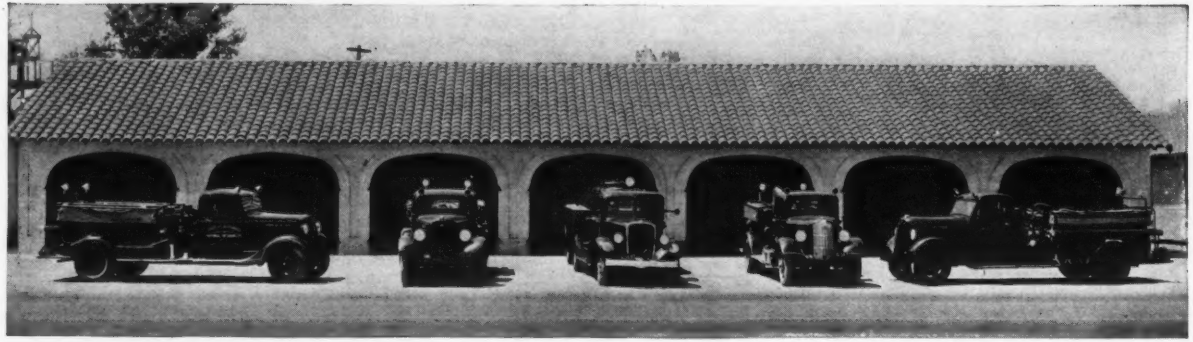
As stated above, the summer of 1928 was marked by an epidemic of serious fires, especially in the grass and grain territory. One of these fires traveled 25 miles through growing grain with a front from six to twelve miles wide. As a result of these fires, it appeared that the farmers would have considerable difficulty the following year in placing fire insurance on their growing grain. The insurance companies had consistently paid out more in losses than they collected in premiums, and the situation became so grave that the Governor of the State appointed a committee from his Council to see what could be done toward protecting this type of property in the future. The Board of Fire Underwriters of the Pacific was called upon to meet with this committee in working out plans for fire protection.

California Rural Fire Institute.

With the assistance of the College of Agriculture, the State Forester and other state officials, a tentative program was drawn up and submitted before a meeting of all those interested in the subject. This was the beginning of the California Rural Fire Institute, which is sponsored by the Department of Agriculture of the University of California. This organization compares in a small way to the National Fire Protection Association, as it acts as an advisory body and draws up standards for rural fire protection in California in much the same way that the N.F.P.A. provides standards for the entire country on all fire protection problems.

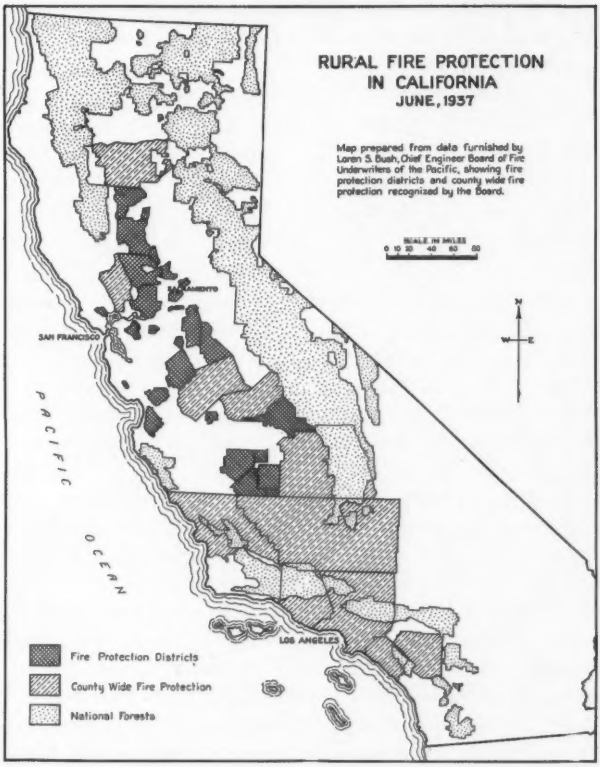
As a result of the work of the Rural Fire Institute, standards were published covering the organization of rural fire departments and the specifications for fire trucks. These standards were primarily designed for combating grass and grain fires, although some equipment was included in the specifications for fighting structural fires. It was found that the equipment was doing remarkable work in stopping structural fires in the rural areas, and in 1932 the specifications were changed to include three types of equipment to correspond to various local conditions.

All of these three types of equipment have some general requirements in common, as it is necessary, for instance, to carry water tanks on all rural fire trucks with a pump designed to take suction from the tank and discharge through small hose lines. The size of the water tank and capacity of the pump, however, depend upon where the truck is to be used. In level country where the principal values are in buildings, a large truck carrying at least 300 gallons of water, a supply of 2½-inch hose, and a pump of approximately 500 gallons per minute capacity is recommended. In the valley where grain is the principal item to be considered, the requirements call for a slightly



Above are shown five of the 23 pieces of fire protection apparatus presently in use in Kern County, California, drawn up in front of department headquarters. Each of these trucks carries its own water tank and pumps to discharge the water through small hose. The 23 trucks, manned by 63 department members, cover about 8100 square miles, an area approximately the size of the state of Massachusetts. The effectiveness of the rural departments' work was shown by a great reduction in rural losses after its institution. Kern County plans to spend $70,000 a year maintaining this protection.

On the left is a view of one of the earliest forms of mechanized rural fire apparatus. Such hand pumps and barrels of water were all that stood between the farmer and the complete destruction of his property until the development of the present protection.


RURAL FIRE PROTECTION
IN CALIFORNIA
JUNE, 1937
Map prepared from data furnished by Loren S. Bush, Chief Engineer Board of Fire Underwriters of the Pacific, showing fire protection districts and county wide fire protection recognized by the Board.
SCALE IN MILES
0 10 20 40 60 80
SAN FRANCISCO
PACIFIC
OCEAN
LOS ANGELES
Fire Protection Districts
County Wide Fire Protection
National Forests

smaller truck carrying at least 250 gallons of water and a pump of at least 100 gallons per minute capacity. In mountainous country where mobility of the apparatus is of prime importance, the specifications recommend a small truck carrying 150 gallons of water and a pump of at least 30 gallons per minute capacity.

Water Supplies

It is, of course, necessary to have considerably more water to fight structural fires than is required in grass and grain fire fighting. This led to the development of local facilities such as connections to the domestic supply (where adequate), building of sumps and providing places to draft from irrigation supplies. Some rural departments have made extensive surveys of their districts and have installed a complete card index of every farm. These cards have a small map showing the proper route to take in order to reach

the property, as well as showing all buildings and the location of water supplies. When an alarm is received the card is taken from the file and carried by the officer in charge to the fire.

This type of survey not only familiarizes the firemen with local conditions, but it also gives the department an excellent opportunity to do fire prevention and educational work.

Transmission of Alarms.

The method of receiving alarms is even more important in rural protection than in cities. Naturally, the telephone must be depended upon to a large extent for this function. In some districts cards are placed on every phone giving instructions on how to report a fire. Where telephones are scarce or service inadequate, lookouts are stationed on towers or mountains. These are of particular importance for grass and grain fires, but have been used to detect structural fires. Each tower is equipped with a map, and by sighting the fire over the map the exact direction can be determined, which is telephoned to headquarters. After receiving reports from two lookouts the exact location of the fire can be determined.

The entire plan of maintenance and support for this protection is based upon state laws, which provide for the organization of fire districts under the supervision of the county. Under the laws, financial support is provided by a tax levied against all assessable property within the district. A district may be disorganized in much the same way that it is organized — that is, by vote of the people. It is interesting to note, however, that of all the rural fire districts organized in the state, not one has ever been dissolved.

Some communities operate on a voluntary basis and finance their fire protection by public subscription. In general, this does not prove satisfactory due to the fact that in a year or so subscriptions become hard to collect and those interested in maintaining the fire protection become discouraged. This, of course, results in deterioration and eventual elimination of the protection.

Organization of Rural Fire Departments.

In promoting rural fire protection, we have, wherever possible, recommended that a city or town fire department form the nucleus for the rural organization. In this connection it might be stated that although the organization of a fire department is just as essential as the furnishing of equipment, it is one of the most difficult things to obtain in rural areas. If a town department can be used to operate in the country, it solves the problem of organization and also solves for the city the problem of responding to fires outside its limits.

The major factor in extending rural protection throughout the state was the expansion of the State Division of Forestry service into the agricultural lands. This form of expansion operates through a coöperative agreement

BROWLEY, GEO. Dist. SALINAS OUTSIDE

Ranch No. 43

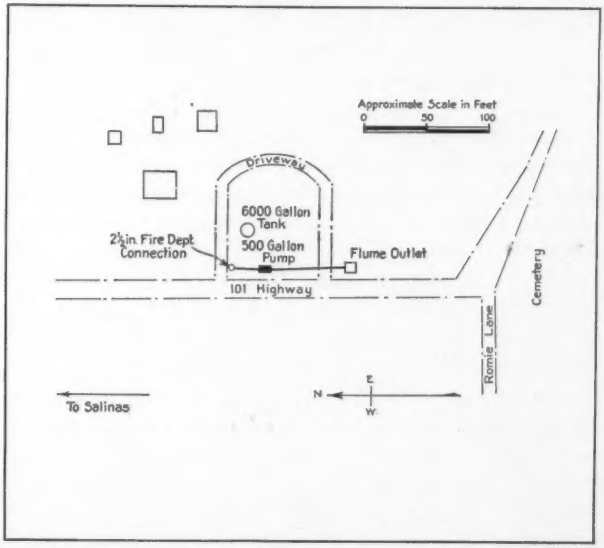
1. Name of ranch and owner .... GEO. BROWLEY
2. Telephone number. ..... 225J .....
3. Location and district ..... ½ MILE SOUTH OF SALINAS ON 101 HIGHWAY .....
4. Number of buildings ..... TWELVE .....
5. Water supply:

Wells 2
Tanks 1
Power supply ELECTRIC & WINDMILL
Pump gallons 500
Fire engine 2½" connection on pump YES
Reservoir gallons
Tank gallons 6,000
Height of tank 25 FT.
Manhole in tank roof YES
Greatest distance building from water supply 150 FT.
Shortest distance building from water supply 15 FT. HEN HOUSE
Neighbor's water supply-tank, gallons ..... pump gallons.....
Distance from neighbor's water supply .....

Remarks: JUST OFF HIGHWAY. BUILDINGS ALL FRAME, GOOD CONDITION, CLOSELY GROUPED. JAP CAMP IN BACK OF BUILDINGS.

Sketch water supplies and roads leading from buildings to same. Use back of sheet.

Remarks: WATER TANK LOCATED IN YARD CLOSE TO HIGHWAY ONSOUTH SIDE. FENCE 15 FT. OUT FROM TANK FRAME. GOOD DRIVEWAY TO FENCE. DEEP WELL PUMP LOCATED BY HIGHWAY ON SOUTH SIDE OF BUILDINGS, EASY TO GET TO. DRAFT FROM LARGE WOODEN FLUME IN GATEWAY. VERY CONVENIENT. PUMP 15 FT. FROM FLUME, STANDARD FIRE CONNECTION 15 FT. FROM ROAD ON MAIN DRIVEWAY. DRAFT DIRECT FROM PUMP.



A card like this is filed in the nearest fire station. On the front are details of interest to the fire fighters; on the back a map of the grounds showing roads, buildings, and water supplies. The fire department plans its operations from this card while running to the fire.

between the State Division of Forestry and the county. If the county supervisors are willing to coöperate with the Forestry Department, they may enter into an agreement with the state to protect all property within the county for a certain specified sum. If the cost of fire suppression exceeds this amount, the expense is borne by the State Forestry Department.

An outstanding example of this form of operation is found in Kern County, which covers an area of some eighty-one hundred square miles, or approximately the size of the state of Massachusetts. This particular part of the state is subject to hot, dry weather and summer temperatures frequently exceed 110° F., and the humidity drops below 10%. It contains rich oil fields and has been subject to severe fires for many years. In 1933 this county decided to expand its rural fire protection through a coöperative agreement plan. It is equipped with sixteen fire trucks at the present time and contemplates the purchase of seven more this year. The supervisors will appropriate $144,000 for rural fire protection this year, or a per capita tax of $5.75. After this year they contemplate the maintenance of this protection will cost approximately $70,000 per year. This is accomplishing rural fire protection in a big way.

From the above it can be seen that there are two directions from which rural protection can expand: first, from the city out into the country and second, from the forest and water shed areas into the agricultural land.

Reduction of Insurance Rates.

Since becoming interested in rural fire protection in 1928, the Board of Fire Underwriters of the Pacific has attempted to make some recognition in the fire insurance rates of the good work accomplished in rural areas. The first credits were given on growing grain only, and were based upon the completeness of the fire protection provided. The maximum credits at that time were 16½%. After observing the good work on structural fires, it was decided to give some recognition in building rates in protected rural areas. Last year the maximum credit on growing grain was increased to 33 1/3% and credits were allowed on pasture insurance in the stock country.

In order to determine the value of the protection, gradings are made of each district. This consists of comparing the protection provided with definite standards and considers such items as personnel of the department, drills and training, organization and fire methods, apparatus, minor equipment, distribution of companies, means of receiving alarms, inspections, fire prevention laws, and records. From this grading the district is placed in one of five classes according to the score made, and credits in rates are allowed according to the classification.

Where credits are to be given on property other than growing grain and pasture, other items are considered. These include the percentage of buildings

within reach of adequate water supplies and modifications in equipment and personnel requirements.

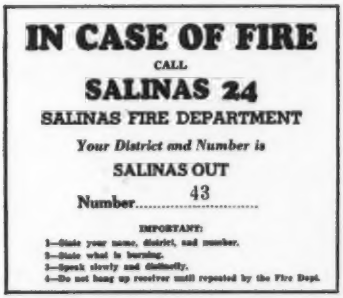
If there is any question regarding the value of this protection to insurance companies, let us again refer to Kern County. The loss ratio in this county on farm property alone for 1932 was 166.5%; in 1933 it was 107.3%; in 1934 the fire protection began to operate, and the loss ratio dropped to 24%. No doubt some of this was due to the drop in losses throughout the United States, but it is certainly more than a coincidence that when fire protection was introduced into the county the loss ratio dropped from 107 to 24%. In 1935 the loss ratio was 42%, and last year it amounted to 39%.

Five Essentials for Rural Fire Protection.

We may conclude that five things are essential in obtaining rural fire protection. First, there must be a desire on the part of the public for this protection. If this is not manifest, there is little use in going further. Second, adequate laws must be enacted for the acquisition, maintenance, and support of the protection. Third, there must be a good fire department organization. Without this there is little use in obtaining the fourth requirement, which is equipment properly adapted to local conditions. The fifth requirement is water supplies available to the department either through sumps, reservoirs, or connections to domestic supplies.

If adequate protection is provided, it benefits the owner, assuming, of course, that he is an honest man; it benefits the insurance company through reductions in losses; and third, it benefits the public in general since burned property cannot be assessed for taxation purposes.

It has been thoroughly demonstrated to the satisfaction of those who have obtained this service that adequate protection can be provided in rural areas if those benefited by it will work together.


IN CASE OF FIRE

CALL

SALINAS 24

SALINAS FIRE DEPARTMENT

Your District and Number is

SALINAS OUT

Number 43

IMPORTANT:

1—State your name, district, and number.
2—State what is burning.
3—Speak slowly and distinctly.
4—Do not hang up receiver until repeated by the Fire Dept.

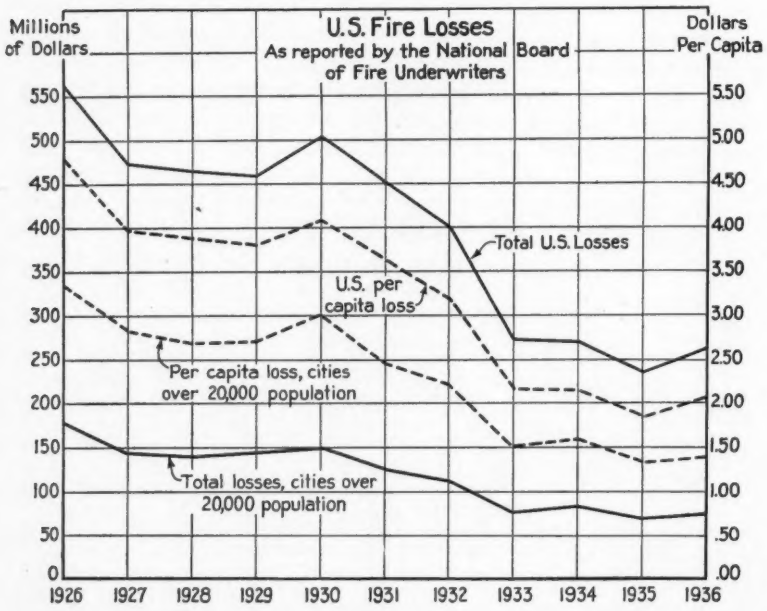
In some districts a card like this is hung on or near every rural telephone to insure correct transmission of alarms.

The 1936 Fire Loss.

Fire losses in the United States for the year 1936 as estimated by the National Board of Fire Underwriters were $263,259,746. This is an increase of about $28,000,000, or 12 per cent, over the 1935 loss — reversing the downward trend of the past five years.

The following table gives the annual fire loss in the United States for the past sixty-two years, and the chart shows a comparison of losses on a per capita basis for the past eleven years. Another table is included to show the per capita losses of all cities of 100,000 population or over for a five-year period.

The year 1936 brought unusually high per capita fire losses to six cities for the second time within five years. These cities are: Leavenworth, Kansas; Charleston, South Carolina; Wilmington, North Carolina; Lewiston, Maine; Paducah, Kentucky; and Westfield, Massachusetts. Two of these cities had fires causing losses of over $250,000 in 1936 and are shown on the Annual Conflagration Map appearing on page 198 of the January, 1937, QUARTERLY. One was Leavenworth with a $500,000 terminal grain elevator fire, and the other was Charleston with a $470,000 steamship terminal fire.



Annual Fire Losses in the United States for Sixty-Two Years.

Year	Property Loss	Year	Property Loss	Year	Property Loss
1875.....	$78,102,285	1896.....	$118,737,420	1917.....	$289,535,050
1876.....	64,630,600	1897.....	116,354,575	1918.....	353,878,876
1877.....	68,265,800	1898.....	130,593,905	1919.....	320,540,399
1878.....	64,315,900	1899.....	153,597,830	1920.....	447,886,677
1879.....	77,703,700	1900.....	160,929,805	1921.....	495,406,012
1880.....	74,643,400	1901.....	165,817,810	1922.....	506,541,001
1881.....	81,280,900	1902.....	161,078,040	1923.....	535,372,782
1882.....	84,505,024	1903.....	145,302,155	1924.....	549,062,124
1883.....	100,149,228	1904.....	229,198,050	1925.....	559,418,184
1884.....	110,008,611	1905.....	165,221,650	1926.....	561,980,751
1885.....	102,818,796	1906.....	518,611,800	1927.....	472,933,969
1886.....	104,924,750	1907.....	215,084,709	1928.....	464,607,102
1887.....	120,283,055	1908.....	217,885,850	1929.....	459,445,778
1888.....	110,885,665	1909.....	188,705,150	1930.....	501,980,624
1889.....	123,046,833	1910.....	214,003,300	1931.....	451,643,866
1890.....	108,993,792	1911.....	217,004,575	1932.....	400,859,554
1891.....	143,764,967	1912.....	206,438,900	1933.....	271,453,189
1892.....	151,516,098	1913.....	203,763,550	1934.....	271,197,296
1893.....	167,544,370	1914.....	221,439,350	1935.....	235,263,401
1894.....	140,006,484	1915.....	172,033,200	1936.....	263,259,746
1895.....	142,110,233	1916.....	258,377,952		

NOTE:—Previous to 1916 figures obtained from the records of the New York *Journal of Commerce*, deducting the Canadian losses. Subsequent years are based on returns to the Actuarial Bureau of the National Board of Fire Underwriters, adding 25% for unreported and uninsured losses. Since 1935, 30% has been added for unreported losses. The figure for 1936 is based on estimates made by the Actuarial Bureau.

Per Capita Fire Losses of Cities Over 500,000 Population.

	Population	1932	1933	1934	1935	1936	Five-Year Average
New York, N. Y.*.....	7,364,000	$3.38	$1.88	$1.75	$1.69	$1.52	$2.04
Chicago, Ill.	3,475,000	3.42	1.64	3.18	1.07	1.78	2.21
Philadelphia, Pa.	1,951,000	2.09	1.19	1.10	1.51	1.21	1.42
Detroit, Mich.	1,595,000	1.82	1.37	1.47	1.23	1.61	1.50
Los Angeles, Calif.....	1,354,000	1.14	.85	.65	.77	.85	.85
Cleveland, O.	940,000	2.26	.94	1.84	1.32	1.23	1.51
St. Louis, Mo.....	900,000	1.67	1.70	1.68	1.13	1.35	1.50
Baltimore, Md.	851,000	3.29	1.68	.84	.94	1.11	1.57
Boston, Mass.	818,000	5.27	2.93	2.94	2.56	3.61	3.46
San Francisco, Calif.†....	725,000	...	...	...	...	...	...
Pittsburgh, Pa.	700,000	1.25	.64	.96	.97	2.25	1.21
Washington, D. C.....	619,000	.72	.80	.48	.90	.66	.71
Milwaukee, Wis.	618,000	1.23	2.23	1.05	.95	.81	1.25
Buffalo, N. Y.....	599,000	2.17	1.69	2.25	1.04	1.49	1.72

*These figures are based on losses paid in New York City by the subscribers to the Actuarial Bureau of the National Board of Fire Underwriters. The fire department estimates for these years were considerably lower.

†Does not report its losses.

Losses in Cities of 20,000 Population or Over.

Losses in cities of 20,000 population and over as reported by fire depart-

ment officials show an increase of 5.3 per cent over 1935. Taking all cities of 20,000 population or over by population groups, the 100,000 to 250,000 population group was the only one to show a decreased per capita loss in 1936 over 1935 — a decrease of 11.8 per cent. The other groups showed increases ranging from 6.4 per cent in the 20,000 to 50,000 group, to 11.0 per cent in the 50,000 to 100,000 population group. The 1936 per capita fire loss for the country as a whole was $2.05, as compared with $1.40 average for the 467 cities of 20,000 population or over. The per capita and total loss figures for cities of over 20,000 population and for the United States for the past eleven years are shown on the accompanying chart.

Cities from 400,000 to 500,000 Population.

	Population	1932	1933	1934	1935	1936	Five-Year Average
Minneapolis, Minn.	492,000	$2.33	$2.35	$1.75	$1.88	$1.59	$1.98
Cincinnati, O.	477,000	1.37	1.30	1.19	.56	1.34	1.15
New Orleans, La.	472,000	1.47	.92	.65	1.32	.71	1.01
Newark, N. J.	450,000	2.14	1.38	1.19	1.69	1.52	1.58
Kansas City, Mo.	445,000	4.05	1.72	1.96	1.91	2.38	2.40
Seattle, Wash.	402,000	2.38	1.16	1.58	1.11	1.77	1.60

Cities from 300,000 to 400,000 Population.

	Population	1932	1933	1934	1935	1936	Five-Year Average
Indianapolis, Ind.	370,000	$1.19	$1.02	$1.23	$1.15	$1.88	$1.29
Louisville, Ky.	370,000	1.53	1.93	1.57	.60	1.45	1.41
Houston, Tex.	365,000	4.86	2.39	1.34	1.23	1.27	2.21
Rochester, N. Y.	335,000	1.26	1.63	1.16	.97	1.53	1.31
Denver, Colo.	325,000	2.18	1.00	1.11	1.33	1.03	1.33
Jersey City, N. J.	325,000	.53	.42	.28	.38	.22	.36
Portland, Ore.	320,000	2.21	2.14	1.98	1.56	1.35	1.84
Columbus, Ohio	310,000	.65	.39	.71	.82	.92	.69
Toledo, O.	309,000	2.06	1.10	1.17	.66	1.42	1.28
Dallas, Tex.	307,000	4.47	3.18	2.86	1.96	2.18	2.93
Oakland, Calif.	305,000	1.44	1.39	1.30	1.09	.92	1.22

Cities from 200,000 to 300,000 Population.

	Population	1932	1933	1934	1935	1936	Five-Year Average
Atlanta, Ga.	297,000	$1.38	$2.17	$ .67	$ .84	$ .83	$1.17
St. Paul, Minn.	293,000	2.67	1.93	2.22	2.63	2.07	2.30
Memphis, Tenn.	283,000	3.19	2.35	2.23	.82	1.53	2.02
Birmingham, Ala.	277,000	1.93	1.28	7.95	2.20	.88	2.84
Akron, O.	255,000	.84	.91	.65	.44	1.07	.78
Providence, R. I.	253,000	1.39	.66	.77	.96	.58	.87
San Antonio, Tex.	253,000	1.44	.64	.41	.60	.60	.73
Omaha, Neb.	225,000	2.87	3.77	1.20	1.33	1.23	2.08
Dayton, O.	220,000	1.73	2.33	1.02	.96	1.03	1.41
Syracuse, N. Y.	217,000	2.49	1.48	2.31	.51	1.58	1.67
Oklahoma City, Okla.	213,000	.77	.38	.46	1.00	.63	.64

Cities from 150,000 to 200,000 Population.

	Population	1932	1933	1934	1935	1936	Five-Year Average
Worcester, Mass.	199,000	$4.62	$1.66	$2.35	$1.72	$1.61	$2.39
Honolulu, Hawaii	195,000	.41	.44	.27	.31	.32	.35
Richmond, Va.	195,000	.65	1.28	.46	.25	.47	.62
San Diego, Calif	180,000	.96	.70	.97	.81	4.27	1.54
Youngstown, O.	180,000	.89	.47	1.23	.79	4.05	1.48
Hartford, Conn.	177,000	1.99	.68	1.19	.91	.93	1.14
Fort Worth, Tex.	175,000	3.96	2.92	2.28	2.68	1.84	2.73
Long Beach, Cal.	170,000	.43	.91	.38	.42	.48	.52
Grand Rapids, Mich.	169,000	.67	.88	.48	.77	1.41	.84
New Haven, Conn.	163,000	1.86	1.75	2.72	1.33	3.28	2.18
Nashville, Tenn.	160,000	4.98	3.96	2.50	2.09	1.43	2.99
Flint, Mich.	156,000	1.17	.96	1.28	.69	1.17	1.05
Miami, Fla.	150,000	1.28	.75	1.14	.72	.49	.87
Springfield, Mass.	150,000	4.14	1.57	2.15	1.40	2.89	2.43
Cities from 125,000 to 150,000 Population.							
Bridgeport, Conn.	147,000	$1.98	$ .47	$ .88	$1.16	$1.11	$1.12
Jacksonville, Fla.	146,000	4.21	2.73	2.00	1.18	1.26	2.27
Scranton, Pa.	145,000	2.84	1.76	2.84	.99	.92	1.87
Des Moines, Iowa	142,000	1.42	1.41	1.49	1.26	2.16	1.54
Tulsa, Okla.	142,000	.84	.84	.70	.94	.91	.84
Yonkers, N. Y.	142,000	1.68	1.72	.61	1.06	.96	1.20
Salt Lake City, Utah	140,000	1.52	1.73	.79	2.09	1.71	1.56
Paterson, N. J.	138,000	2.41	1.83	2.00	.50	3.70	2.08
Spokane, Wash.	135,000	1.74	2.21	.86	1.67	1.05	1.50
Norfolk, Va.	130,000	3.12	2.42	3.12	2.63	1.67	2.59
Albany, N. Y.	127,000	1.73	1.69	1.35	1.27	1.14	1.43
Kansas City, Kans.	125,000	2.69	.68	3.79	1.81	.79	1.95
Cities from 100,000 to 125,000 Population.							
Elizabeth, N. J.	124,000	$2.22	$1.19	$ .56	$ .59	$ .73	$1.05
Trenton, N. J.	123,000	1.12	2.04	.51	.40	.30	.87
Chattanooga, Tenn.	120,000	1.27	2.63	1.23	.92	1.73	1.55
Erie, Pa.	120,000	1.86	.68	.51	3.27	.41	1.34
Fort Wayne, Ind.	120,000	1.02	.69	.74	.43	.98	.77
Peoria, Ill.	120,000	3.29	.89	1.27	31.93	3.16	8.10
Cambridge, Mass.	119,000	3.57	1.29	1.28	2.12	1.20	1.89
Camden, N. J.	119,000	1.86	1.68	1.49	1.28	1.41	1.54
Fall River, Mass.	117,000	2.36	2.16	2.62	1.06	.69	1.77
Knoxville, Tenn.	117,000	1.18	.66	.98	.70	.49	.80
Tampa, Fla.	117,000	1.94	.87	.71	2.92	1.21	1.53
Wichita, Kans.	114,000	1.13	.95	.65	.81	1.23	.95
Reading, Pa.	113,000	.76	1.10	.35	1.21	.87	.85
Tacoma, Wash.	112,000	2.51	1.85	4.70	5.06	2.05	3.23
New Bedford, Mass.	110,000	.87	.83	.61	.42	.89	.72
Wilmington, Del.	110,000	2.01	2.37	1.12	1.32	3.24	2.01
Evansville, Ind.	108,000	1.97	1.13	1.19	.78	2.61	1.53
Canton, O.	105,000	.97	.57	.65	.52	.95	.73
Gary, Ind.	105,000	3.54	.61	.34	.57	.48	1.10

	Population	1932	1933	1934	1935	1936	Five-Year Average
South Bend, Ind.	104,000	1.20	.75	.77	1.79	1.00	1.10
Waterbury, Conn.	104,000	2.33	1.98	1.51	1.04	3.29	2.03
El Paso, Tex.	103,000	1.02	.50	1.23	.31	.30	.67
Somerville, Mass.	103,000	2.54	2.40	3.29	1.14	.88	2.05
Utica, N. Y.	103,000	4.09	1.84	1.69	1.02	1.10	1.94
Lynn, Mass.	102,000	4.71	2.85	1.94	4.42	2.76	3.33
Duluth, Minn.	101,000	3.48	2.01	1.52	1.65	2.96	2.32
Lowell, Mass.	100,000	2.46	2.08	1.49	1.34	1.27	1.72

U. S. Losses Slightly Lower for First Part of 1937.

Fire losses in the United States for the first five months of 1937 were $131,145,479, which is $3,937,968, or 2.9%, less than for the same period last year, according to estimates of the National Board of Fire Underwriters.

	1934	1935	1936	1937
January	$28,002,583	$23,430,504	$27,729,930	$25,069,895
February	31,443,484	25,081,625	30,909,896	28,654,962
March	31,312,359	24,942,703	29,177,406	29,319,029
April	22,028,943	23,267,929	25,786,835	26,663,854
May	25,271,459	21,238,205	21,479,380	21,437,739
Total—5 months	$138,058,828	$117,960,966	$135,083,447	$131,145,479

Canadian Fire Losses, 1936.

Canadian fire losses for the year 1936 amounted to $21,549,484, sustained in 42,644 fires, according to statistics furnished by J. Grove Smith, Dominion Fire Commissioner. This loss figure shows a reduction of $1,672,037 (or 7.2%) from the 1935 property loss, and continues the downward trend started in 1932. The 1936 loss was approximately one-half the 1932 loss. The number of fires reported in 1936 showed a slight increase — 42,468 were reported in 1935. Loss of life from fire increased from 293 in 1935 to 347 in 1936. This was the greatest number in any year since 1927.

Losses by Provinces.

	Population	Loss, 1935	Per Capita Loss, 1935	Loss, 1936	Per Capita Loss, 1936
Alberta	772,000	$1,087,614	$1.39	$1,098,889	$1.43
British Columbia	750,000	1,941,702	2.64	1,689,718	2.25
Manitoba	711,000	1,040,135	1.40	846,283	1.19
New Brunswick	435,000	1,058,704	2.46	885,644	2.04
Nova Scotia	537,000	1,155,759	2.19	1,246,767	2.32
Ontario	3,690,000	8,164,350	2.27	7,867,483	2.13
Prince Edward Island	92,000	167,303	1.88	164,141	1.78
Quebec	3,096,000	7,404,965	2.41	6,645,210	2.15
Saskatchewan	931,000	1,188,694	1.22	1,080,925	1.16
Not reported	.....	12,295	...	24,424	...
Total	11,014,000	$23,221,521	$2.12	$21,549,484	$1.95

A Decade of Fire Losses in Canada.

Year	Property Loss	Per Capita	Year	Property Loss	Per Capita
1927	$32,254,084	$3.29	1932	$42,193,815	$4.06
1928	36,402,018	3.79	1933	32,676,314	3.15
1929	47,499,746	4.85	1934	25,437,840	2.44
1930	46,109,875	4.70	1935	23,221,521	2.12
1931	47,117,334	4.54	1936	21,549,484	1.95

Population Group Loss Classification.

Group	Total Loss, 1936	Per Capita
Cities over 10,000 population	$7,284,123	$1.60
Towns 5,000 to 10,000 population	978,024	2.14
Towns 1,000 to 5,000 population	1,206,553	1.78
Villages under 1,000 population	2,639,424	4.98
Rural districts	9,441,360	1.99
Total	$21,549,484	$1.95

Occupancy Record.

	1936		Ten Years 1927-1936	
	No. of Fires	Loss	No. of Fires	Loss
Dwellings (all classes)	31,801	$8,099,883	284,165	$106,429,815
Farm property (excluding dwellings)	3,526	2,804,973	42,315	37,516,004
Retail and wholesale stores	3,753	4,602,376	46,273	88,229,837
Manufacturing properties	868	3,526,546	9,012	61,526,090
Churches, schools and institutions	492	1,383,575	5,137	20,089,552
Miscellaneous property	2,204	1,132,131	35,074	19,670,733
Total	42,644	$21,549,484	421,916	$333,462,031

Statistics of Fires in Canadian and Foreign Cities, 1936.

Reported by National Board of Fire Underwriters. Losses are figured at par exchange.

City	Population	Per Capita Loss
Canada		
Hamilton	154,000	$ .81
Montreal	1,233,000	1.44
Toronto	638,000	1.32
Winnipeg	225,000	.82
Great Britain		
Birkenhead	150,000	.14
Birmingham	1,038,000	1.28
Bolton	175,000	1.00
Bradford	298,000	2.69
Brighton	148,000	.13
Cardiff, Wales	222,000	.68
Edinburgh, Scotland	465,000	4.61
Glasgow, Scotland	1,131,000	.53
Kingston-on-Hull	325,000	.83
Leeds	483,000	1.69
Liverpool	858,000	.15
London	4,397,000	1.02
Manchester	842,000	1.64
Southampton	177,000	.48
Stoke-on-Trent	274,000	.18
York	87,000	.41
Europe		
Vienna, Austria	1,854,000	.09
Bordeaux, France	263,000	.41
Lyon, France	590,000	.50
Hamburg, Germany	1,101,000	.15
Stuttgart, Germany	434,000	.48
Oslo, Norway	270,000	2.80
Stockholm, Sweden	545,000	5.25
China		
Shanghai	3,684,000	.08
New Zealand		
Wellington	188,000	.43
Philippine Islands		
Manila	284,000	1.32

Rats, Mice, and Matches.

In recent years stories of fires caused by mice or rats gnawing the tips of ordinary matches and igniting them have been very largely discredited. This theory flourished for a time as a convenient excuse for fires which would otherwise have been of admittedly unknown origin. It was often used by investigators who were inclined not to be over thorough in their work. The idea caught the public imagination. In many cases it led to householders carefully sealing up their kitchen matches in tin boxes, safe from rodents.

In 1915 the legend of mice and matches suffered a staggering blow with the publication of a report prepared by engineers interested in fire protection at the request of the Diamond Match Co. This report, entitled "No Fires from Rats and Matches," related how tests were made to determine the true extent of this hazard. Rats and mice were caught at various times, and under varying conditions, in order to get a representative cross section of the varmints, and confined in tile cages with wire ends. A counted number of matches were placed in the cages as the only food possibility. It was noted that the rats and mice, without exception, starved to death or ate each other without ever resorting to sampling either the heads or the splints. This experiment was tried with all sorts of cages under all sorts of conditions. Mice were allowed to become acclimated, subjected to the test in twos, fours, sixes and greater

This picture shows a mouse nest in a box of matches, with the young mice in the nest. The box was taken out of a closed case of matches into which mice had gnawed. The case had been stored in a warehouse of the Diamond Match Co. for a considerable time.

In the Diamond match plant the overflow from machines is generally thrown into cases of loose matches. In one of these cases in the corner of a plant, mice made the above nest. Although the splints had been shredded, none of the heads was touched.

numbers, as well as singly, and still there was no sign of the matches holding any fascination for the rodents. This was shown to be the case with not one, but all types of matches.

Other Experiments.

Several years before these experiments an investigation had been conducted by Underwriters' Laboratories under the direction of A. H. Nuckolls (Member N.F.P.A.), to ascertain the possibility of matches being gnawed and ignited by rats and mice. It was ascertained at that time that, while there might be some inducement to rodents in the paste used in the manufacture of paper match boxes, there seemed to be no basis for the belief that they like to eat or gnaw the heads of matches. The Laboratories also showed by cutting tests that mice or rats would have considerable difficulty in igniting the matches then labeled by the Laboratories, even were they to gnaw them.

Since the appearance of this article several occurrences in actual experience have corroborated this research. In the manufacture great numbers of matches are piled in warehouses or overflow from machines and are dumped without sorting into open cases. Evidence of the splints having been gnawed by the rodents has been noted, but there has yet to be reported a case where heads have been touched.

However, while rats and mice do not start fires by gnawing matches, it is entirely possible that when the rodents carry matches to use in building nests the heads may be rubbed against hard objects and thus start fires. Furthermore, the weight of a rat might be enough to strike one match head against

another and thus conceivably cause ignition. In the QUARTERLY for April, 1925, page 335, is reported an apparently well-authenticated case where a mouse in search of peanuts started a fire in a desk, the fire going out for lack of air and thus preserving the evidence. In this case there is nothing to indicate that the mouse gnawed the match, but according to the report the mouse and match theory was the only possible explanation.

While it is clearly proved that rats and mice do not gnaw match heads, the fact remains that loose matches are readily susceptible to ignition from friction of any kind, and the only safe procedure is to keep them in proper containers.

Kansas Gasoline Truck Ordinance Upheld.

As an aftermath of two serious gasoline tank truck fires, the Board of City Commissioners of Ottawa, Kansas passed, on July 29, 1936, an ordinance prohibiting the transportation by tank trucks of petroleum products in quantities over six hundred gallons through or into the City of Ottawa. (See QUARTERLY Vol. 30, No. 2, p. 145.) In a district court, the gasoline transport companies affected by the ordinance obtained a permanent injunction to restrain the Ottawa city officials from enforcing it. The city officials appealed the case in the Supreme Court of Kansas and, on May 8, 1937, in the case of Everett Ash vs. E. V. Gibson, a 6 to 1 opinion reversing that of the district court was filed. Justice Allen delivered the sole dissenting opinion, basing his case on a Supreme Court of Illinois decision[1] that highway traffic, even in municipalities, is a state affair. But by the majority it was held that the ordinance prohibiting tank trucks was a valid exercise of the police power of the city; that the authority to enact such an ordinance had not been taken away by the adoption of the state highway amendment and the enactment of statutes creating a state highway system, nor by the enactment of statutes providing for rules and regulations governing the transportation of gasoline; that the ordinance was not unreasonable, discriminatory nor an arbitrary prohibition of the use of the highway, and was not an undue burden on interstate commerce. Excerpts from the opinion as delivered by Justice Smith follow:

This is an appeal from a judgment of the Franklin District Court enjoining the enforcement of an ordinance of the city of Ottawa. The city officials are the appellants, but shall be termed the defendants, since the plaintiffs are attacking the validity of the ordinance.

The ordinance sought to be enjoined is as follows:

Section 1. It shall be unlawful for any person, firm or corporation to transport gasoline, naphtha, kerosene, distillate, oil or other inflammable or explosive oil derivatives

[1] Chicago Coach Co. vs. City of Chicago 337 Ill. 200, 169 N.E. 22, 66 A.L.R. 834.

into or through the city of Ottawa, Kansas, by means of motor vehicle, motor truck or combination of motor truck and trailer or other vehicle, over and upon any of the streets, avenues or alleys of said city of Ottawa, Kansas, lying west of Lincoln street and north of Fifteenth street; provided, that this section shall not apply to or restrict the transportation of such commodities in railroad tank cars upon tracks maintained through said city or to the transportation of such commodities into or through said city in quantities of six hundred (600) gallons or less.

Section 2. That any person, firm or corporation violating the terms of this ordinance shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in a sum of not less than five dollars ($5) nor more than one hundred dollars ($100).

Section 3. That due to the menace to the public safety of life and property in said city, an emergency is hereby declared to exist and this ordinance shall take effect and be in force immediately upon its passage and publication according to law.

The first argument of the plaintiffs is that the city had no authority, express or implied, to pass the ordinance. They state a rule with which we can all agree, as follows:

> The power to pass a city ordinance must be vested in the governing body of the city by the legislature in express terms, or be necessarily or fairly implied in and incident to the powers expressly granted, and must be essential to the declared purposes of the corporation. Any fair and reasonable doubt concerning the existence of the power is resolved by the courts against the corporation.[2]

The plaintiffs then point out that if the city has the authority claimed it must derive it from statutes[3] which confer authority on the governing body of the city to enact ordinances, rules, regulations and by-laws that may be expedient for maintaining the peace and welfare of the city. They then cite the undisputed fact that nowhere in these statutes is power conferred on the governing body of the city in express terms to prohibit the transportation of gasoline products.

From that point the plaintiffs refer to the constitutional amendment, wherein the people of the state provided for a uniform system of highways, and the statutes enacted pursuant to this amendment providing for the creation of the system and for regulation and control of traffic over it. There are in force a number of statutes dealing with transportation of gasoline.[4] These provide mainly for licensing of carriers and fuel taxes.

The plaintiffs refer to ordinances conferring on the public service commission the authority to license, supervise and regulate motor carriers,[5] contract motor carrier permits;[6] make safety rules and regulations for motor carriers,[7] and the motor fuel tax statute.[8]

---

[2] Anderson vs. City of Wellington, 40 Kan. 173, 176, 19 Pac. 719.
[3] G.S. 1935, 14-401, 14-418, 14-421, 14-439, 12-848, 8-124, 8-125, 14-432 and 68-155.
[4] G.S. 1935, 55-506, 55-507, 55-508, 55-509 and 55-510.
[5] G.S. 1935, 66-1,108, and 66-1,112.
[6] G.S. 1935, 1,112a.
[7] G.S. 1935, 66-1,129.
[8] G.S. 1935, 79-3,401.

The argument that the governing body of the city did not have authority to enact the ordinance in question is based on decisions to the effect that where a city ordinance is in conflict with the state statute the state statute must govern and the ordinance is void.

The Extent of Municipal Self-Government.

The question of the degree of self-government that shall be invested in local communities is older even than our government. Early in the history of this country the local unit was the town. Since the founding of our state the legislative policy has been to confer on the cities the right of self-government in such large measure that it amounts to the possession of police power where the safety, health and general welfare of its people are concerned.[9] The only limitation on it is that it must be exercised in a reasonable manner.[10]

There are two views to take of this question. One is the traditional view that this right is a precious thing inherent in the rights of man generally. We have seen that this view has been entertained generally by the people of our race for many years. The other view is that it is a practical necessity in order to make our form of government work at all, extending as it does over a wide expanse of territory and touching widely different situations and communities. Considering the present situation, it can readily be seen that a general statute could not adequately and efficiently cover the movement of gasoline in trucks through every city of the state. In some cities an ordinance could be passed routing the trucks through a sparsely settled portion of the city where the danger of damage from an explosion would be relatively slight. So a limitation of the amount of the load would not need to be put into effect. In some other cities some other way might be devised to meet the situation. The business in which plaintiffs are engaged is a comparatively new one and it is not surprising that different cities in the state have different ideas as to how best to regulate it within their borders.

Before this court would hold that the adoption of the highway amendment, and the enactment of the statutes pursuant thereto, had taken away from the cities of the state the right to regulate a business as dangerous as the transportation of gasoline through these cities, it would have to appear clearly from the statutes by plain provisions that such was the intent of the legislature. We have looked for such provisions and fail to find them. We are compelled to reach the conclusion that the problem of regulating this traffic on the highways outside the cities is one thing and the regulation of it within the limits of a city is another and that the latter is within the province of the governing bodies of the cities.

---

[9] See Service Oil Co. vs. City of Marysville, 117 Kan. 514, 231 Pac. 1031.
[10] See Standard Oil Co. vs. Marysville, 279 U. S. 582, 73 L. Ed. 856.

The plaintiffs next argue that the ordinance is unreasonable and discriminatory, and an arbitrary prohibition of the use of the highway. On this point the argument is that the ordinance in effect compels them to detour around the city of Ottawa with their loaded trucks so that they are prohibited from the use of the streets of the city. Many authorities are cited and relied upon holding that the power to regulate does not include the power to prohibit. In this connection it should be pointed out that the stipulation as to the facts does not state that the enforcement of the ordinance will stop the traffic in which the plaintiffs are engaged. It only states that if the ordinance is enforced it will cause them to incur expense which they did not contemplate at the time they entered into certain contracts with persons for whom they are now transporting gasoline.

The plaintiffs are claiming the right to use the highways of the state and the streets of the city for the purpose of transporting goods for hire. They have no inherent right to so use the streets.[11]

If the ordinance is a reasonable exercise of the police power of the city the fact that its enforcement makes it a financial burden on the plaintiffs does not render it void. This brings us to a consideration of whether the ordinance is reasonable. On this question we receive some light from decisions of the Supreme Court of the United States.

United States Supreme Court Decision on Gasoline Storage.

Considering the validity of an ordinance that required all gasoline tanks of more than ten gallons capacity to be buried three feet under ground, the court said:[12]

> The master found that gasoline and kerosene stored in large quantities are dangerously inflammable substances, as we judicially know[13] which, when ignited, are a menace to life and property in the vicinity; that even with the use of the most modern safety devices, fires or explosions of such storage tanks occur and that within the four years preceding the trial five disastrous fires of gasoline storage stations had occurred in Kansas, in two of which gasoline tanks had exploded, in one case striking and burning a building 475 feet away, killing nine people, wounding twenty-six more and burning several other houses. His findings show that within an even smaller radius from petitioners' tanks, or within the same or adjacent blocks, there are many buildings, including residences, a hotel, warehouses and garages, some of wooden structure, and gasoline and kerosene storage tanks of 75,000 gallons capacity, and that the principal business street of the town is within two blocks of the Standard tanks. From local conditions and recent public improvements the master found it reasonable to conclude that there would be increased residential building in the vicinity.

Considering the validity of that same ordinance,[14] this court stated that it would take judicial notice of the same fire spoken of by the supreme court

---

[11] Peoples Taxicab Co. vs. City of Wichita, 140 Kan. 129, 34 P. 2d 545, and cases cited.
[12] Standard Oil Co. vs. Marysville, 279 U. S. 582.
[13] Pierce Oil Corporation vs. City of Hope, 248 U. S. 498, 500.
[14] Service Oil Co. vs. City of Marysville, 117 Kan. 514, supra.

of the United States. The stipulation in this case refers to two disastrous fires that occurred in Ottawa prior to the enactment of the ordinance as the result of the overturning of two transport trucks loaded with gasoline. In addition to the statement in the stipulation this court will take judicial notice of the fact that a cargo of gasoline moving along the streets of a city in a truck subject to traffic hazards and to the physical frailties of the driver is more dangerous to the people of the city than the same amount of gasoline in a stationary tank.

A truck is propelled by an internal combustion engine and in such an engine there is always some fire present. Whenever an accident occurs there need be only the ignition of the escaping fumes by a heated pipe or some other part of the engine to cause a fire or explosion. Care on the part of the driver of the gasoline truck will not meet the situation. A collision caused by the negligence of the driver of some other vehicle on the street would result in just as disastrous consequences to inhabitants of the city as though it had been caused by the negligence of the driver of the truck. The unusual hazard sought to be avoided is the presence of the large amount of this dangerous substance on the streets. Obviously the fact that the prohibition of such a dangerous condition will result in loss to the plaintiffs does not affect the reasonableness of the manner in which the governing body of the city in the exercise of its best judgment sees fit to deal with the situation.

Relation to Interstate Commerce.

The plaintiffs next argue that the ordinance is a burden on intrastate and interstate commerce. It is admitted by everybody that some of the tank truck traffic through Ottawa moves in interstate commerce. On this point the plaintiffs cite and rely on authorities holding that a state or municipality of a state cannot fetter the right to carry on interstate commerce within the borders by imposing conditions or regulations which are unnecessary and which pass beyond the bounds of what is reasonable and suitable for the proper exercise of its powers. From what has already been said in this opinion, it is plain that we hold that the ordinance in question is a reasonable exercise of the powers of the city.

Considering statutes of states requiring compliance with the laws of the state by residents of other states, using the highways of the state, the U. S. supreme court said:[15]

"In the absence of national legislation covering the subject a state may rightfully prescribe uniform regulations necessary for public safety and order in respect to the operation upon its highways of all motor vehicles — those moving in interstate commerce as well as others."

---

[15] Hendrick vs. Maryland, 235 U. S. 610, 59 L. Ed. 385.

The ordinance in question is a valid exercise of the police power of the city, and its effect on interstate commerce is only incidental to its object, the protection of the lives and property of the inhabitants of the city.

The plaintiffs do not press the argument in their brief that the ordinance is void because it deprives them of their property without due process of law. What has already been said is an answer to that proposition.

Brief of Amicus Curiae.

An able brief of amicus curiae was filed in this action. This brief takes up the cudgels on the part of the plaintiffs. The gist of one argument is that by the enactment of statutes for licensing[16] of carriers engaged in the transportation of petroleum products, the legislature has adopted a policy with which this ordinance is inconsistent, and to which it is repugnant. These statutes have been considered by us together with the fact that the state fire marshal has issued rules and regulations as to equipment and management of trucks being used in transporting gasoline along the highways of the state. We do not find in them that denial of police power necessary to confer authority to enact the ordinance in question which we have held was necessary to deprive city governing bodies of their authority.

The next argument in this brief is that the ordinance does not bear any real or substantial relationship to the general welfare of the people. What we have already said is an answer to that argument.

The plaintiffs do not press the argument in their brief that the ordinance expressly excludes from its provisions gasoline being moved by rail and hence is an unreasonable discrimination. We have examined this question, however, and have concluded that there is enough difference in the conditions under which the two kinds of traffic move that the distinction is not an unreasonable one.

The judgment of the trial court is reversed with directions to set aside the injunction granted, and to enter judgment for defendants.

---

[16] G.S. 1935, 55-507, 55-508 and 55-510.

Vienna Fire Department Modernized.

By Boris Laiming,
(Member N.F.P.A.).

The city of Vienna, Austria, one of the oldest European capitals, with a present population of about 2,000,000, has been a city of great importance for many centuries. From the standpoint of fire protection, it carries the distinction of having been the first city to organize a regular paid fire department 250 years ago, in 1686, when a city ordinance was passed authorizing the hiring of firemen who were to perform duty day and night. Since that time, the Vienna fire department developed into one of the model fire departments of Europe, after performing uninterrupted duty for 250 years, with headquarters still located in its original building at the civic center. The Vienna fire department has been a progressive one, and evidence of this is found in its record of improvements. For example, the first two automatic aerial ladders were placed in service in Vienna in 1899, motorizing of the department started in 1903, radio was first introduced in 1925, and a far-reaching plan of reorganization of the entire fire department was put into effect during the span of years 1925 to 1929. It is noteworthy that this plan was not carried out following fire catastrophes, but was a progressive scheme developed through detailed consideration of changed physical conditions, and of the best methods in dealing with those conditions from the standpoint of sound administrative policy.

During the period of reorganization, the area of the city, equal to about 106 square miles, and its population of about 2,000,000, remained substantially unchanged. Prior to the year 1925, Vienna was protected by a paid fire department consisting of 15 stations, and by 48 volunteer fire companies in the suburban areas. By the end of 1929, the number of paid fire department stations was increased to 29, while only 8 volunteer stations remained in service pending completion of the reorganization plan which called for a total of 33 regular paid stations. The changes in fire department distribution brought about by the reorganization scheme in Vienna are shown in the sketch map. Tables I and II illustrate the conditions as to personnel, stations and apparatus before and after the reorganization plan went into effect.*

TABLE I.
Fire Protection in Vienna.

	Number of Fire Stations		Personnel		Fire Apparatus	
Year	Paid F. Dept.	Volunteer	Paid F. Dept.	Volunteer	Paid F. Dept.	Volunteer
1920	15	48	1159	1431	92	185
1929	29	8	1019	232	165	25
Final Plan	33	..	....	....	...	...

*"Bericht über die Tätigkeit und Verwaltung der Feuerwehr der Stadt Wien von I Jänner 1920 bis 31 Dezember 1929."

The present distribution of the functional units of the Vienna fire department enables it to cover the city in such a manner that the first companies arrive at the fire no later than within four minutes after the alarm is received.*

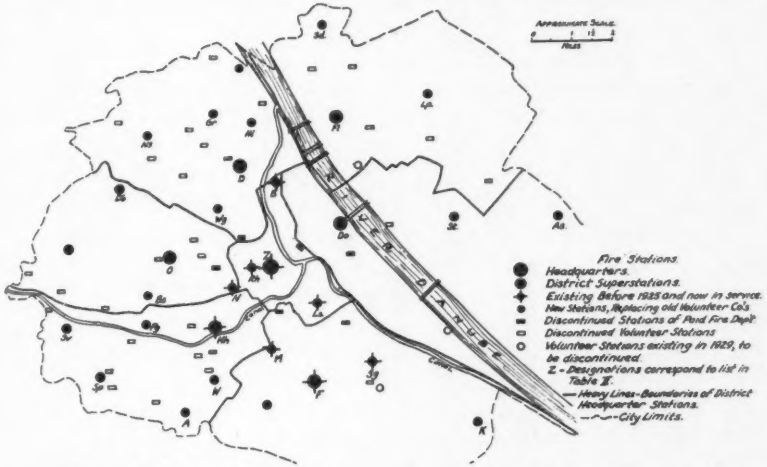

Approximate Scale.
Miles
Fire Stations.
Headquarters.
District Superstations.
Existing Before 1925 and now in service.
New Stations, Replacing old Volunteer Co's
Discontinued Stations of Pond Fire Dept.
Discontinued Volunteer Stations
Volunteer Stations existing in 1929, to be discontinued.
Z - Designations correspond to list in Table II.
Heavy Lines-Boundaries of District Headquarter Stations.
City Limits.

Fig. 1. Map of Vienna, showing fire department stations before and after reorganization.

As may be noted from Table II and Table I, there was no increase in fire department personnel following reorganization, in spite of the fact that the number of fire stations and apparatus nearly doubled. The plan was made possible by a redistribution of the fire personnel at the stations, drastic reduction of details, elimination of steamer engineers and stokers with the substitution of steamers by motor pumpers, and a reduction of the number of alarm operators resulting from the discontinuance of many volunteer companies to which they were detailed. The number of employees, other than fire personnel, was also drastically reduced from 181 to 40 by transferring many functions from special employees to the fire personnel on duty. While the motor apparatus of the regular fire department was nearly doubled, the less effectively employed apparatus of volunteer companies was reduced from 185 pieces to 25 in 1929, to be totally eliminated later.

The new organization provides for a division of the city into seven fire protection districts, as shown on the map, comparable in a general sense to battalion districts in American cities. A centrally located district superstation is equipped with six pieces of fire fighting apparatus, comprising 2

*"Die Feuerwehr der Stadt Wien" von Ing. Johann Stanzig, Feuerschutz No. 8, August, 1936, p. 127.

TABLE II.

Re-distribution of Stations, Personnel and Apparatus in Vienna.

Designation on Map	Fire Stations Name of Station	Fire Personnel on Duty 1920	1929	Apparatus in Service Fire Duty 1920	1929	Administration 1920	1929
Z	Zentrale (H)	135	74	17	18	8	12
Rh	Rathaus	5**	12	..	2	..	..
Ls	Landstrasse	6	6	1	2	..	..
N	Neubau	9	8	2	2	..	..
	*Breitenfeld	6	..	1	..	..	..
	*Alsergrund	6	..	1	..	..	..
B	Brigittenau	11	16	2	3	..	..
	*Leopoldstdt.	10	..	1	..	..	..
	*Prater	17	..	3	..	..	..
Do	Donaustadt (D)	..	27	..	6	..	..
St	Stadlau	..	6	..	2	..	..
As	Aspern	..	6	..	2	..	..
F	Favoriten (D)	34	27	8	8	5	..
	*St. Marx	6	..	1	..	..	..
	*Wieden	9	..	2	..	..	..
M	Margareten	11	6	2	2	..	..
Sg	Simmering	16	11	3	2	..	..
K	Kaiserebdf.	..	11	..	2	..	..
Mh	Mariahilf (D)	39	27	5	6	..	..
W	Wienerberg	..	14	..	3	..	..
A	Altmannsdorf	..	6	..	2	..	..
Sp	Speising	..	11	..	2	..	..
Pg	Pensing	..	6	..	2	..	..
Sv	St. Veit	..	11	..	2	..	..
O	Ottakring (D)	..	27	..	6	..	..
Bs	Breitensee	..	11	..	2	..	..
Db	Dornbach	..	11	..	2	..	..
Wg	Währing	..	6	..	2	..	..
D	Döbling (D)	..	27	1***	6	6	..
Hi	Heiligenst.	..	6	..	1	..	..
Ns	Neustift	..	11	..	3	..	..
Gr	Grinzing	..	6	..	3	..	..
Fl	Florisdorf (D)	12	27	3	7	..	..
Lp	Leopoldau	..	6	..	2	..	..
Sd	Strebersdorf	..	6	..	2	..	..
Total on duty.....		332	429	53	104	19	12
Detail to vol. sta.....		47	1	..	..	..	..
Special duty.....		28	1	..	..	..	..
Reserve (sick, etc.).....		82	59	15	46	5	3
Total each shift.....		489	490	..	..	..	..
Other employees		181	40	..	..	..	..
Grand total, employees....		1159	1019	..	..	..	..
Grant total, apparatus....		..	..	67	150	24	15
Volunteer		1431	232	185	25	..	..

*Sta. discontinued. **No apparatus. ***No crew assigned.
(H) Headquarters. (D) District super-station.

pumpers, 1 booster wagon, 1 automatic aerial, 1 hose wagon, and 1 squad wagon, carrying about 6000 feet of 2-inch hose, and personnel of 27 men. (Fig. 2.) Special duty apparatus is kept at fire department headquarters and at some other stations. Stations other than the super-stations are equipped with two pieces of apparatus, a booster wagon and a pumper, to which an aerial is added where building conditions require.

Fig. 2. District super-station, equipped with six pieces of apparatus and having 27 men on duty.

Six pieces of apparatus (as in a super-station) constitute the normal operating entity of the Vienna fire department responding to first alarms. To fires away from a super-station, a local station and a pumper from another station are dispatched, while the balance of the apparatus necessary for a normal operating unit responds from the district super-station, with a fire engineer (chief officer) riding on the squad wagon equipped with a radio receiving and sending set. (Fig. 3.) Additional help, when needed, is called in terms of normal units of 6 pieces of apparatus.

The equipment carried on all apparatus, except aerials, is standardized, and all are capable of independent action at a fire. This is claimed to afford greater flexibility to the organization and easier handling of assignments of different units at a fire or other emergency. A typical pumping engine of the Vienna Fire Department is shown in Fig. 4. It is rated at 500 liters (135 gallons) per minute at 20 atmospheres (300 lbs. per. sq. in.) pressure. Booster pumps are rated at half that capacity at the same pressure.

Fully realizing the differences attending the problem of estimating pumping capacities required at fires of different nature, the Vienna fire department has kept careful records for 25 years of pumping equipment, pressures, nozzles and hose used at various fires, and arrived at the conclusion that, for general fire fighting purposes, the required pumping capacity may be roughly estimated in each case on the basis of floor areas involved by fire. Experiments and careful observations showed that extinguishment of an area of 50 sq. meters (about 545 sq. ft.) required a delivery of 250 liters (about 67 gallons) of water per minute. The Vienna fire department therefore standardized upon the use of fire streams with ½-inch tips delivering about 65 gallons of water per minute. A stream of such volume can be supplied by a booster wagon, and two similar streams by each pumper using direct layouts of 2-inch hose.

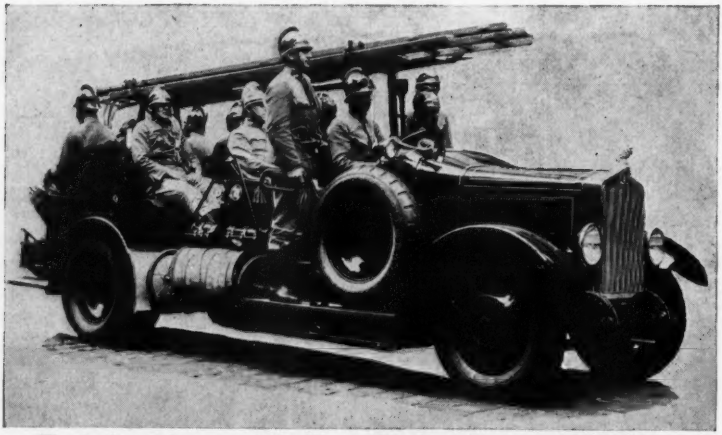


Fig. 3. A squad wagon of the Vienna Fire Deparment, equipped with a radio receiving and sending set.

The first alarm assignment can place 5 ordinary streams in operation and cover a fire area of 250 square meters. When heavier streams are needed at large fires, lines are siamesed.

To promote efficiency and proper training in the various branches of the service, the Vienna fire department has classified its functions under seven subdivisions,* namely: 1. Fire prevention; 2. Fire fighting and service in event of air raids; 3. Flood service; 4. Traffic, building and industrial accident service; 5. Mechanical service; 6. Relations service; and 7. Welfare and rescue service. Those services operate in each of the 7 fire protection districts shown on the map, under the direction of the District Fire Engineer. General administrative problems are handled at Headquarters by 17 special divisions or bureaus. The apparatus and equipment stationed in the seven districts is so apportioned as to cover the area in the most adequate manner possible in relation to prevailing local hazards. However, standardization of the equipment carried on different apparatus makes it possible for all the functional units of the department to perform various kinds of work without calling special equipment, except in exceptional cases.

In conformity with such an organization plan, a rather unusual system of instruction for the personnel has been developed. A fireman who joins the department goes first through a training period of 8 hours daily instruction for three months, and learns the fundamentals of fire department work, whereupon he is assigned to a station. At the stations, the three last days of the week are devoted to maintenance work and general drills, while during the

*"Die Feuerwehr der Stadt Wien" von Ing. Johann Stanzig, Feuerschutz No. 8, August, 1936, p. 127.

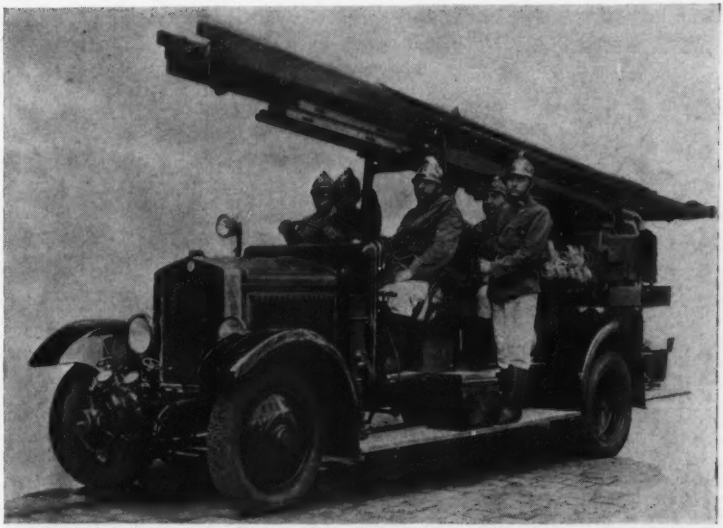


Fig. 4. A typical pumping engine of the Vienna Fire Department, equipped with centrifugal pump delivering 160 gal. per minute at 300 lbs. pressure. Hose is carried coiled.

first three days of the week the entire personnel in each of the 7 fire protection districts is schooled in one of the seven above-mentioned functional subdivisions of the service. This instruction is given by a junior fire engineer who has gone through a preliminary one-year training period in that particular branch of the service. After one year service in one district, the men are assigned to another district, where they are thoroughly instructed in another branch of the service, and so on until in the course of seven years complete training has been achieved in all branches of the service. A similar system of training is used for fire engineers (chief officers), of whom the Vienna fire department has 24 at present, with the distinction that each year of special instruction in a particular branch of work is followed by one year teaching experience. It takes thus 14 years for a fire engineer to become fully qualified for the duties of a district chief officer. A ten months' intensive training course is given firemen who aspire for promotion to petty officers (captains).

Concluding this description of the principal features of the fire service in Vienna, it is interesting to note that the close contact achieved between the different branches of the service through the peculiar system of instruction and personnel assignment prevailing in that city is coincident with an extremely low fire loss record maintained for many successive years. The National Board of Fire Underwriters figures credit Vienna with annual fire losses in the neighborhood of 10 cents per capita. While favorable local con-

ditions may account for much of the consistently good fire loss record of the city of Vienna, scientific coördination of the various branches of the fire service built up over a period of many years with due regard for local requirements must, no doubt, share much of that credit for a good record.

Winnipeg Fire Prevention Progress.

Thomas Baird, fire marshal of Manitoba, has contributed these pictures taken of exhibits in the Winnipeg Safety Parade in May, arranged by the Bureau of Labor and Fire Prevention. The sign on the old horse-drawn steamer shows a 1916 fire loss of $1,242,405 in Winnipeg; that on the modern pumper a 1936 loss of $184,240. A similar exhibit for St. Boniface showed a reduction in the same period from $769,367 to $7524. These reductions in loss are due in part to the superiority of modern equipment, but also in large part to persistent fire prevention work.

Company Financed Lightning Rods.

By E. S. Craig, General Manager,
Grain Insurance and Guarantee Co., Winnipeg,
(Member N.F.P.A.).

For several years the Grain Insurance and Guarantee Company has been making special studies of the causes and means of preventing lightning losses on the approximately 3500 grain elevators which it insures in Western Canada. Insuring this class of property was considered unprofitable previous to 1920, but since that time the company's success in this field has largely resulted from recognition of the fact that in a specialized line at least, active measures of loss prevention are as important to profitable insuring as a prudent underwriting policy. To carry out this principle, the company maintains a continuous physical inspection procedure of the insured elevator properties. Also, through the coöperation of the insured, plant additions such as the installation of lightning rods and fire extinguishers have been made to reduce fire hazards. The fire extinguishers are regularly serviced by the company's inspectors.

While there is still much to be learned about the prevention of lightning losses on grain elevators, broad experience with a single type of structure which is particularly exposed to lightning damage has enabled the company to make useful observations on the problem. The potential loss to such structures is very great because the areas most subject to lightning storms are those receiving abundant moisture and producing large crops. As a result of this, grain storage facilities are often concentrated at central points. At one such point, for example, there are nine closely adjacent elevators, of which this company insures five. In the event of a conflagration here, the company's loss alone could in normal times reach nearly $200,000.

Company Financed Installations.

It was not only with a view to reducing exposure and other hazards that the company was anxious to see lightning rods installed, but also from a wish to see the insured obtain a reduction in their insurance costs. Negotiations with the Western Canada Underwriters' Association resulted in having them extend the rate reduction for lightning rods, which then applied to grain elevators, to the contents as well. It was then proposed that the insured permit the company to finance the entire installation of lightning rods — the company to be reimbursed from the savings in premiums, which the insured would pay at the old rate until such a time as the work was paid for.

This proposal was naturally accepted in all cases. Proposals were called for and the contract for the work was given to a company in Missouri. The

work was practically completed in one summer, giving the insured immediate benefit of the discount and the protection. The plan was soon followed by other owners of grain elevators, with the result that there now remain practically no elevators in Western Canada without lightning rod protection.

It was originally expected that it would require about five years for the premium discounts to pay for the installations, but because the quantity of grain under insurance increased so greatly during the ensuing years, three years reductions were sufficient. The lightning rod installations are now the property of the insured, who are now receiving the direct benefit of the reduction. Since these installations were made, the company has not had a single loss attributable to lightning. All installations are regularly checked by the company's inspectors.

Contract Specifications.

The contract entered into by the company with the construction company contained detailed material specifications. The type of grounding to be used for different soils must conform to the requirements of the Underwriters' Laboratories of Canada, and all materials must be subject to the acceptance of the Laboratories in point of metals, design, and specifications. This entire procedure was designed to secure permanently effective protection as specified in the N.F.P.A. Code for Protection Against Lightning.

All materials used and typical installations were inspected by the Underwriters' Laboratories of Canada, who issued individual labels accordingly. Underwriters' Laboratories, Inc., of Chicago, assisted in the preparation of the specifications. The materials actually used in the lightning rod installations exceeded in quality what the specifications required, as it was considered advisable to take advantage of the low price of copper and secure the longest life possible.

In drawing up the contract and carrying out its provisions it was necessary to have in mind the terms of the lightning rod acts of the Provinces of Alberta and Saskatchewan, and also the regulations stating the minimum requirements for lightning protection prescribed under the acts. The Province of Manitoba does not have such an act, but installations the company made there were identical to those made in the other provinces.

Flammable Liquid Storage in Flood Areas.

After the flood waters of the Ohio River had receded and the disastrous effects of the oil fires (see QUARTERLY, Vol. 30, No. 4, pp. 322-357) could be studied, a committee of fifteen, representing the American Petroleum Institute, the International Association of Fire Chiefs, and the National Board of Fire Underwriters, set out under the chairmanship of Harry E. Newell, Secretary of the N.F.P.A. Committee on Flammable Liquids, to devise safeguards that would, in the future, prevent this fire hazard from becoming operative. After making a factual investigation of the action of oil storage tanks under abnormal flood conditions, the committee in April issued a report on Safeguards for Flammable Liquids Storage Tanks in Regions Subject to Floods, including a section on Recommended Safeguards and Safe Practices. The following paragraphs are excerpts from the report of the committee on its general findings, and a complete reprint of the recommended safeguards:

During the past twelve months unprecedented floods in Connecticut, Pennsylvania, Ohio, Indiana and Kentucky have resulted in great damage to properties which had never been inundated. Hundreds of tanks containing flammable liquids have been surrounded by flood waters. Some, owing to the small amount of liquid within them at the time, floated from their foundations, the escaping flammable liquid finding its way to the surface through broken pipe connections. The number and extent of fires which occurred in this connection were sufficient to demonstrate beyond all question the potential hazard of flammable liquid storage in regions subject to floods.

Aboveground Tanks.

Vertical Tanks.

Consideration of methods for protecting vertical aboveground tanks against flood damage must be based on either of two general theories. Either the weight of the tank, its contents, and any supplemental loading must be sufficient to overcome the buoyant effect of the flood waters, or the tank must be considered to be a piece of floating equipment under flood conditions.

From an engineering point of view liquid loading is the only method directly applicable to overcoming the buoyancy of existing storage tanks. It does not produce stresses in the tank structure other than those which the tank is designed safely to withstand. Hydrostatic pressures are equalized and, except in the case of a movement of the tank, or in cases of impact from floating débris, tanks will suffer no structural injuries when loaded with liquids.

The use of concrete loading appears to be impracticable for storage tanks. Calculation proves that if the bottom of the tank is to be secured to a con-

crete foundation to prevent floating when the tank is empty, and the flood waters reach a depth of 30 feet around the tank, it would be necessary to provide a concrete foundation 21.73 feet thick. Under the same conditions it would be necessary to provide 12.6 feet of concrete within the tank to keep it from floating. Not only is the necessary quantity of concrete excessive, but the structure of the tank itself is incapable of withstanding the external hydrostatic pressure which would be created by flood waters rising to any appreciable height around an empty tank. The tank bottom, which is the weakest section of vertical storage tanks against external pressure, might fail when the flood waters rose only a short distance above the bottom of an empty tank.

Although during the recent flood there were cases where relatively high concrete dikes prevented tanks from drifting away from their locations, and in some of these cases the dike wall enclosures served to retain quantities of flammable liquids which escaped through broken pipe connections, dike wall enclosures cannot in general be made economically to serve both as a means of preventing the escape of flammable liquid, and protecting the tanks from damage by flood waters.

Practical applications of the theory of protecting floating tanks are mainly lacking. Yet it possesses some merit and soundness from an engineering viewpoint. A number of steel columns around the outside should prove effective in holding the floating tank in its place so that it will return to its foundation when the flood waters recede.

Horizontal Tanks.

The loading of empty horizontal aboveground tanks with concrete is subject to the same criticism as that directed against empty vertical tanks. Due to their small capacity these tanks may easily be protected against external pressures by completely filling them with liquid. This is necessary to prevent deformation of the tank and resultant expulsion of flammable liquid.

Underground Tanks.

Vertical tanks are never buried underground. The extent to which the protection of underground horizontal tanks is feasible is set forth in detail in the Recommended Safeguards and Safe Practices following the general conclusions of this report.

General Conclusions.

The committee reached a definite conclusion as to the character of safeguards which should be employed. In arriving at this conclusion, due consideration has been given to the emergency features of design and construction involved, economic feasibility, and the extent to which specific safeguards should be required for existing and future tanks, respectively.

It is the committee's opinion that compliance with the following recommended safeguards will afford a reasonable and acceptable degree of protection for aboveground and underground flammable liquid tanks under abnormal flood conditions. The committee accordingly recommends their adoption as ordinance requirements in regions subject to floods such as those which have occurred during the past year in the Connecticut, Ohio and Mississippi river valleys.

Recommended Safeguards and Safe Practices for the Protection of Tanks Containing Flammable Liquids in Flooded Regions.

General. Pipe connections below allowable liquid level in tanks shall be provided with valves or cocks located as closely as practicable to tank shell. Such valves and their connections and fitting to the tank shall not be of cast iron.

Section A. Aboveground Tanks.

1. Vertical Tanks.

(a) No aboveground vertical storage tank containing flammable liquids shall be so located that the maximum allowable liquid level within the tank is below the established maximum flood stage, unless the tank is provided with a guiding structure such as described in Section D.

Except at locations where there is an ample and dependable public water supply available at and below the established maximum flood stage, facilities independent of public water supply shall be provided for loading partially empty tanks with water.

(b) In addition to the preceding requirements, each tank so located that more than 70 per cent but less than 100 per cent of its allowable liquid storage capacity will be submerged at the established maximum flood stage shall be safeguarded by one of the following methods:

1. Tank shall be raised, or its height shall be increased until its top extends above the maximum flood stage a distance equivalent to 30 per cent or more of its allowable liquid storage capacity, provided, however, that the submerged part of the tank shall not exceed 2½ times the diameter; or,

2. As an alternative to the foregoing, adequate incombustible structural guides, designed to permit the tank to float vertically without loss of product, shall be provided.

2. Horizontal Tanks.

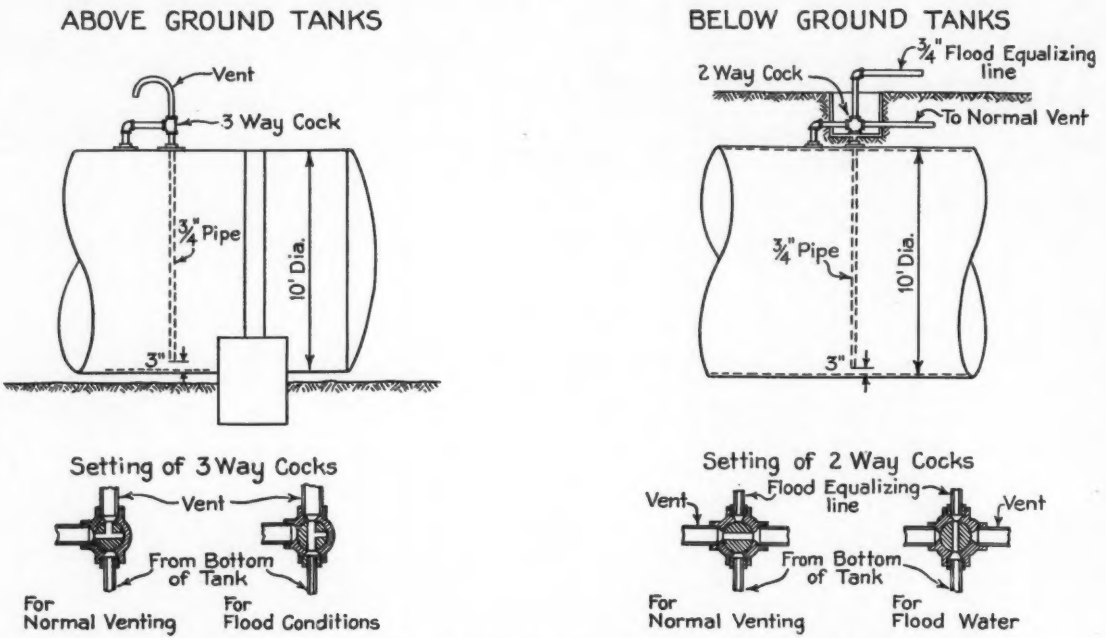
(a) Except at locations where there is an ample and dependable public water supply available at and below the established maximum flood stage, facilities independent of public water supply shall be provided for loading partially empty tanks with water.

(b) Each horizontal tank so located that more than 70 per cent of its storage capacity shall be submerged at the established maximum flood stage, shall be secured to a concrete or steel and concrete foundation of sufficient weight to produce adequate loading of tank when filled with flammable liquids.

(c) Special provision shall be provided to equalize the internal and external pressures on the tank so as to prevent deformation of the tank and resultant expulsion of flammable liquid. One method of accomplishing this equalization of pressures is illustrated in Exhibit A following.

3. Other Types of Tanks.

Spherical and spheroidal tanks shall be protected by applicable methods as specified for either vertical or horizontal tanks.



Arrangement of venting equipment for horizontal tanks which may be submerged by flood waters.

Section B. Underground Tanks.

1. Underground tanks containing liquids having flashpoint below 100 degrees Fahrenheit at locations where there is an ample and dependable water supply available at and below the maximum flood stage and so installed that more than 70 per cent of storage capacity will be submerged at the maximum flood stage, shall be loaded with concrete or other approved loading material sufficient to prevent movement of the tank when filled with flammable liquid and submerged by flood waters.

2. At locations where there is no ample and dependable water supply, the tank shall be loaded with concrete as above required and in addition, there shall be provided an emergency liquid supply which shall be sufficient to fill the tank during flood stages.

3. Where loading of underground tanks with liquids is impracticable because of the character of their contents or their use, each tank shall be safeguarded against movement when empty and when submerged by flood waters by loading with concrete or other approved solid loading material. Each such tank shall be so constructed and installed that it will safely resist external pressures due to flood waters.

4. In addition to the foregoing requirements the capacity of each new tank installed shall be restricted to not more than 3000 gallons. When installed but before backfilling, tank and fittings shall be tested for tightness at not less than 15 pounds per square inch. Greater test pressures may be required by the authority having jurisdiction when tanks are subject to submergence in excess of 30 feet.

5. Where tanks are not designed to resist external pressure, special provision shall be provided to equalize the internal and external pressures on the tank so as to prevent deformation and resultant expulsion of flammable liquids. (See illustration opposite.)

Section C. Independent Water Supply Facilities.

1. At locations where an independent water supply is required, it shall be entirely independent of public power and water supply. Independent source of water shall be available when flood waters reach a level not less than 10 feet below the bottom of the lowest tank on a property.

2. The self-contained power and pumping unit shall be so located or so designed that pumping into tanks may be carried on continuously throughout the rise in flood waters from a level 10 feet below the lowest tank to the level of the potential flood stage.

3. Capacity of the pumping unit shall be such that the rate of rise of water in all tanks shall be equivalent to the established potential average rate of rise of flood waters at any stage.

4. Each independent pumping unit shall be tested periodically to insure that it is in satisfactory operating condition.

Section D. Structural Guides.

1. Structural guides for holding floating tanks above their foundations shall be so designed that there will be no resistance to the free rise of a tank, and shall be constructed of incombustible material.

2. The strength of the structure shall be adequate to resist lateral movement of a tank subject to a horizontal force in any direction equivalent to not less than 25 pounds per square foot acting on the projected vertical cross-sectional area of the tank.

3. Where tanks are situated on exposed points or bends in a shore line where swift currents in flood waters will be present, the structures shall be designed to withstand a unit force of not less than 50 pounds per square foot.

Section E. Safe Practices.

1. Water Loading.

(a) The filling of a tank to be protected by water loading shall be started as soon as flood waters reach a dangerous flood stage. The rate of filling shall be at least equal to the rate of rise of the flood waters (or the established average potential rate of rise).

(b) Sufficient fuel to operate the water pumps shall be available at all times to insure adequate power to fill all tankage with water.

(c) All valves on connecting pipe lines shall be closed and locked in closed position when water loading is completed.

2. Floating Tanks.

(a) Where structural guides are provided for the protection of floating tanks, all rigid connections between tanks and pipe lines shall be disconnected before the flood waters reach the bottom of the tank, unless control valves and their connections to the tank are of an approved type of extra heavy construction, designed to prevent breakage between valve and tank.

(b) All valves attached to tanks other than those used in connection with water loading operations shall be closed and locked.

(c) If a tank is equipped with a swing line, the swing pipe shall be raised to and secured at its highest position.

Section F. Enforcement and Inspections.

Because of its relation to the general problem of fire prevention and extinguishment in connection with the storage of flammable liquids, it is recommended that the enforcement of the foregoing requirements be placed with the fire department.

The chief of the fire department or other enforcing official shall make periodic inspections of all plants where the storage of flammable liquids is such as to require compliance with the foregoing requirements, in order to assure the following:

1. That all flammable liquid storage tanks are in compliance with these requirements and so maintained.

2. That detailed printed instructions of what to do in flood emergencies are properly posted.

3. That station operators and other employees depended upon to carry out such instructions are thoroughly informed as to the location and operation of such valves and other equipment necessary to effect the intent of these requirements.

Hindenburg Fire, Lakehurst.

What will probably prove to be the largest loss fire of 1937 occurred on May 6, when the German Zeppelin Hindenburg burst into flames near the tail while landing at Lakehurst, New Jersey, at the end of one of her transatlantic flights. Once started, the flames spread over the 803-foot ship at a rate estimated at 50 yards per second. Fabric that was thin enough to constitute almost no obstruction in the fall of an occasional wrench or other tool dropped by a mechanic working inside the great silver hull of the ship, as shown by small holes where such tools had torn through, did not offer any slow-burning qualities to prevent the ship from being totally consumed in just a few short moments. Some of the many competent observers at the scene noted that the destruction was completed in exactly 32 seconds. In 32 seconds the once moot question of the safety of passenger transport by lighter than air craft was swung far toward the negative.

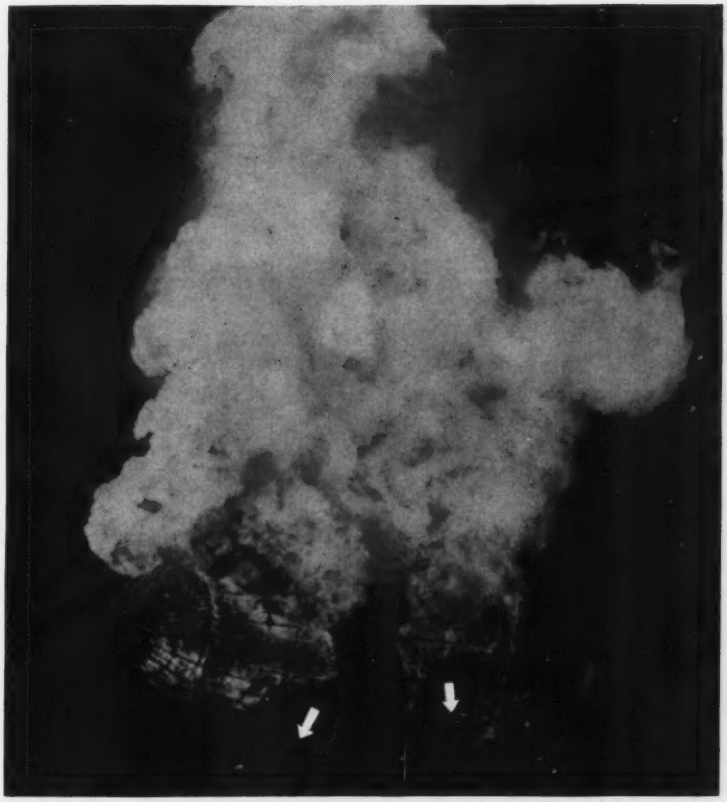
This was the 119th and the largest airship built in Germany. It, and all but one of its predecessors, was filled with flammable hydrogen. Ten others, planned but not built, were also designed for use with this gas. It is difficult to understand how the safe passage of 7,063,000 cubic feet of hydrogen in a bag subject to all the hazards of nature could be expected for even one trip. Of the 118 previous Zeppelins six mysteriously disappeared, 21 were dis-

Pictures, Inc.

This view shows the apparatus and men of the Lakehurst fire station beginning operations on the fire burning in the escaped engine fuel of the Hindenburg.

Pictures, Inc.

From this picture it can be seen that the 803-foot ship was less than 300 feet above the ground when the fire enveloped her tail. The ship fell away from the gas as it burned, leaving flames hundreds of feet in the air.



Pictures, Inc.

The control room and the passenger spaces, shown by arrows, were the last portions of the ship to be reached by fire. At the time this picture was taken, passengers and crew were dropping to the ground and making their miraculous escape.

mantled, 18 were surrendered or destroyed during the war, and 71 were involved in accidents of one sort or another. The now long grounded, helium-filled Los Angeles, and the long lived Graf Zeppelin are the only two now in existence. This is an impressive record of failure, and yet the extreme foresight, constant vigilance, and understanding of the terrific hazards by her German masters brought the Hindenburg safely through ten round trips across the Atlantic. That same thoroughness has made it possible for the old Graf to cheat nature in eight years of safe flying. Sparks from her engines have trailed harmlessly into space behind her for all that time without once encountering proper conditions for igniting an escaping wisp of hydrogen. The Los

Angeles worked out her usefulness under the comparative security of inert, non-flammable helium. Her sound construction was proof against the structural failures that dumped other helium-filled ships into the rubbish pile.

The Hindenburg was not under such a lucky star. A spark from her engines, a static spark, perhaps a hot exhaust pipe found the proper concentration of hydrogen, and 36 lives and $3,750,000 in property disappeared.

Philadelphia Waterfront Fire.

A large section of the Philadelphia, Pa., waterfront was menaced on May 30, 1937, when fire destroyed Pier 12, which was owned and operated as a freight depot by the Baltimore & Ohio Railroad. The loss was estimated at $185,000. Adjacent piers and boats on both sides for hundreds of yards were threatened. Four boats, including the 4500-ton freighter, *Exchange*, owned by the American Export Line and berthed at Pier 12, were set on fire by flaming brands carried by the wind. Seventeen engine companies, 5 truck companies, 2 high pressure companies, 1 water tower, 1 rescue company, and 2 fireboats responded to fight the blaze and wet down other waterfront structures.

Pier 12 was a one-story building of wood and galvanized iron. It was 545 feet long. Along with a small quantity of miscellaneous freight on the pier were 60 tons of crated empty bottles, a refrigerator car of meat, and a consignment of oil in drums. Also on the pier was a refrigerating system with ten large cylinders of ammonia gas which threatened the safety of firemen.

Story of the Fire.

The flames were first discovered by two harbor patrol policemen stationed in the vicinity. They notified the watchman on the pier and turned in the alarm. The watchman testified that he had made his tour of duty at 6:30 P.M., and had noticed no fire or smoke. He had just started his 7:30 round and claims to have discovered the smoke at the same time that the two policemen ran into the pier to notify him. The first alarm went in at 7:50 P.M., and within the next nine minutes four extra alarms were sounded.

By the time the last piece of fire apparatus arrived, the strong wind had spread the fire to almost every section of the pier and firemen could get no farther than about ten yards inside the pier. Several hose lines were operated in this entrance. Firemen poured water into the pier from five hose lines operated from a temporarily vacant pier structure on the south side of Pier 12, and additional lines were operated from Pier 13 to the north. Two fireboats with their pumps going full force supplemented the work of the firemen in the entrance of the pier and on both sides. The fireboats were directed from the shore by radio. Sparks showered the decks of the boats and dense smoke hid

Acme.

Philadelphia firemen battling a four alarm waterfront fire, which destroyed Pier 12 of the Baltimore and Ohio Railroad on May 30, 1937, with a loss of approximately $185,000.

them from view, but the firemen stood by their posts at the stationary nozzles and poured tons of water on to the pier.

Sparks ignited the ties of the high speed electric railway line on the Delaware River Bridge which was almost directly above the pier. Service on the line was suspended for half an hour. Heavy black smoke from the creosoted timber of the pier tangled traffic on the bridge, and the heat scorched the paint on the structure. Three barges caught fire from the heat and firebrands carried by the wind. Flying brands also ignited a canvas hatch cover on a 4500-ton freighter which was berthed at Pier 12.

The sides of a tugboat moored near by were scorched and the decks were blistered. Due to the effective work of the fire department, no appreciable damage was done to adjoining piers. Fifteen firemen were treated for burns and inflamed eyes, and two spectators were overcome by smoke.

Loss and Cause.

From the very beginning firemen concentrated their efforts on preventing the spread of the fire, as it was virtually a foregone conclusion that the pier could not be saved. Officials of the Baltimore and Ohio Railroad who owned the pier estimated the loss to the pier at $175,000, loss of meats in cold storage at $3000, and loss of other freight in the depot at $7000, making a total loss of $185,000.

The origin of the sudden outbreak of fire is still undetermined. A short circuit in refrigeration machinery or a discarded cigarette thrown from the Delaware River Bridge were suggested as possible causes. The fire started at a point about 100 feet from the water end of the pier.

Conclusions.

It was brought out in the investigation conducted by the Fire Marshal of the Philadelphia Fire Department that there had been six or seven fires on this pier within the past few years, which were extinguished by the watchman and sometimes with help, but which were never reported to the fire department. Had they been reported, such a chronic condition could possibly have been corrected and complete destruction of the pier averted in this fire. Apparently about fifteen minutes were lost before the alarm was sounded. It is hardly conceivable, if the watchman had been doing his duty, that this fire could have gained such headway. There were five stations on the pier which the watchman visited every hour with his watchman's clock. As the clock was destroyed in the fire there was no way of checking his tour of inspection. Testimony of the watchman indicated that he tried to get in touch with the officials of his company when he learned of the fire, instead of sending an alarm to the fire department.

As a result of this fire a committee headed by the Assistant Director of the Department of Public Safety of the City of Philadelphia and composed of prominent citizens and pier owners has been formed. The Fire Marshal and this committee plan to draw up fire protection regulations to control the fire hazard of piers. Apparently no effort has been made to control this hazard within the past 25 years. In addition to drawing up regulations and getting the owners of piers along the waterfront to comply with them, the committee intends to rejuvenate the watchman system and regulate the storage of combustible materials on piers.

Krause Milling Co. Explosion and Fire.

Nine employees lost their lives and twenty-six others were injured in the explosion and fire which destroyed about one-half of the Charles A. Krause Milling Company plant in the town of Greenfield, Wisconsin (adjoining Milwaukee), on April 10, 1937. All investigations have not been completed, but the explosion is believed to have been caused by an accumulation of grain dust set off by a spark. The plant and its contents were valued at $2,000,000, and the loss is estimated at $1,250,000.

Building Construction and Equipment.

The Krause plant, built in 1926, was of modern fire-resistive construction, and was one of the largest corn milling plants in the world. The layout of the buildings, the fire area, and the area heavily damaged by the explosion are shown on the accompanying map.

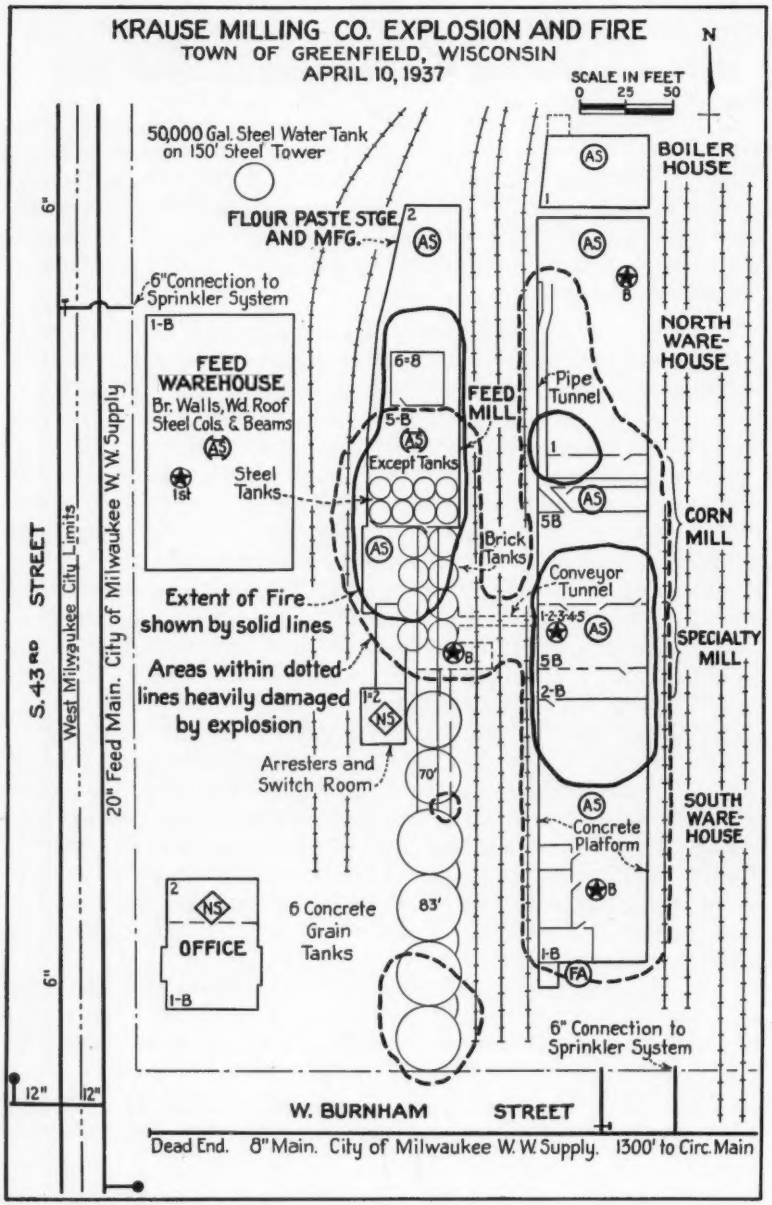
The east group of buildings (boiler house, north warehouse, corn mill, specialty mill, and south warehouse) were separated from the buildings on the west by a space of about forty feet with three railroad sidings. One underground conveyor tunnel connected the two groups. The specialty mill was a two and five story and basement building, with reinforced concrete frame and floors, brick walls, and tile roof. The corn mill was a five story and basement building, with reinforced concrete frame, brick walls, and concrete floors and roof. The north and south warehouses were one story and basement, with brick bearing walls and concrete floors. The north warehouse connected with the corn mill through a pipe tunnel.

In the west group, the feed mill was a five story and basement building, with steel frame and 8-inch panel walls on stories below the steel tanks and corrugated metal above the tanks. The flour paste storage and manufacturing building was a two story building of the same construction as the corn mill. The brick grain tanks had an incombustible conveyor. The two concrete tanks to the south of the brick tanks had a concrete gallery above. The four large concrete tanks had a concrete roof over all. A full continuous basement extended beneath all tanks.

According to a preliminary investigation made by the Industrial Commission of Wisconsin on April 16, the buildings in general appeared to conform to building code requirements, both as to type of construction and as to

---

NOTE: This account has been prepared from a preliminary report issued by the Industrial Commission of Wisconsin to the Wisconsin Legislature, and from information from various other sources. Official reports of investigations by the United States Department of Agriculture, and the Fire Insurance Rating Bureau have not been released.


KRAUSE MILLING CO. EXPLOSION AND FIRE
TOWN OF GREENFIELD, WISCONSIN
APRIL 10, 1937
SCALE IN FEET
0 25 50
N
50,000 Gal. Steel Water Tank on 150' Steel Tower
FLOUR PASTE STGE. AND MFG.
BOILER HOUSE
NORTH WARE-HOUSE
6"Connection to Sprinkler System
1-B
FEED WAREHOUSE
Br. Walls, Wd. Roof Steel Cols. & Beams
1st
Steel Tanks
6-B
5-B
Except Tanks
FEED MILL
Pipe Tunnel
Brick Tanks
Conveyor Tunnel
CORN MILL
SPECIALTY MILL
SOUTH WARE-HOUSE
Extent of Fire shown by solid lines
Areas within dotted lines heavily damaged by explosion
Arresters and Switch Room
Concrete Platform
6 Concrete Grain Tanks
83'
70'
OFFICE
S. 43RD STREET
West Milwaukee City Limits
20" Feed Main. City of Milwaukee W. W. Supply
6"
12"
W. BURNHAM STREET
Dead End. 8" Main. City of Milwaukee W. W. Supply. 1300' to Circ. Main

Milwaukee Journal.

This picture shows obstacles encountered by Milwaukee and West Allis firemen in fighting the fire in the workhouse on top of the steel grain tanks of the feed mill.

exit facilities. Where building walls were still standing, it was found that fire doors had been provided for protection of openings. In general the windows were wired glass in steel sash, but the plant engineer indicated that whenever glass replacement was necessary, plain glass had been used instead of wired glass to lessen the resistance to possible explosions.

Milwaukee Journal.

The shipping shed in the foreground was completely demolished by the explosion. In the background are the specialty and corn mills, and at the left are the concrete grain tanks, part of which were heavily damaged.

An addition had recently been made to the north of the corn mill from plans which had been approved by the county building inspector. Plans for a fire escape on the new north wall of this building, however, had been submitted to the Industrial Commission for approval and had been accepted with some required changes which it was found had been incorporated in its erection. This fire escape permitted the escape of at least two men at the time of the explosion, who otherwise would have been trapped in the building.

Tunnels containing material conveyors connected several units of the plant. There were no shut-offs in the tunnels, and they were not required by

the state building code. Materials within the corn mill had been in general conveyed through galvanized iron ducts, although it was not possible at the time of the investigation by the Industrial Commission to determine their condition. Apparently some effort had been made to exhaust dust from some of the machines through galvanized iron ducts leading to collectors on the roof.

Automatic sprinkler protection had been provided in all buildings in which the fire occurred. They were two-supply dry pipe systems. One supply was a 50,000-gallon steel gravity tank elevated forty feet above the roof of the highest building. The other supply was through two 6-inch connections to 6-inch and 8-inch mains of the Milwaukee water system.

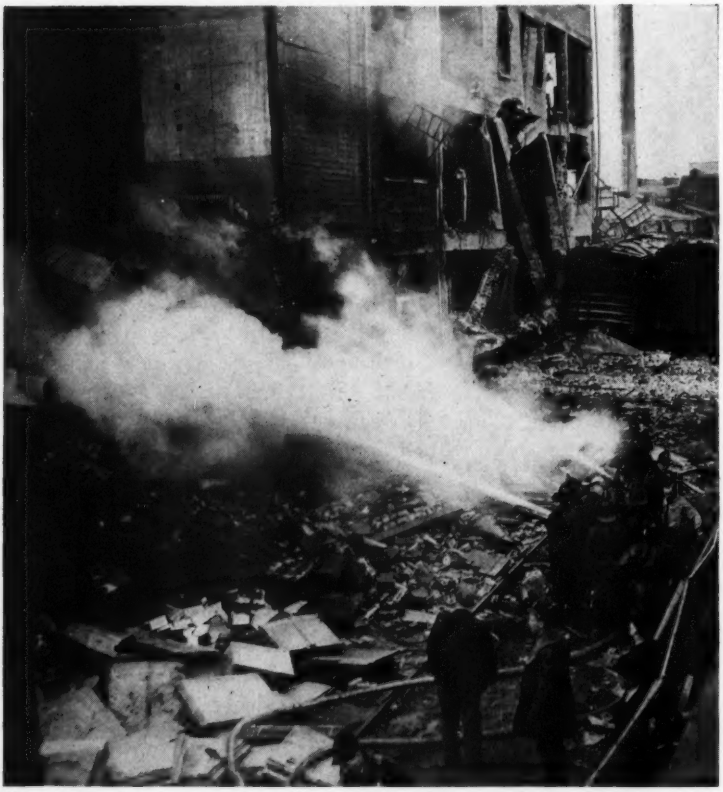
Electrical wiring was installed in rigid conduit. In most locations where dust would be expected to accumulate, lamps were inclosed in dust-tight globes, and those subject to mechanical injury were protected by guards. Motors were of the standard squirrel-cage type and the wound-rotor slip ring type. The Wisconsin State Electrical Code permits the use of squirrel-cage motors in locations where the atmosphere may be dusty, but where dust does not accumulate in such quantities as to interfere with the ventilation of the equipment. The code calls for totally inclosed specially ventilated motors if they have arcing or sparking parts.

Quite a number of the electrical controllers were of the oil immersion type. Some disconnect switches were not of the approved dust-tight type. In some places the control equipment had been grouped in rooms planned to keep out the dust, but the effectiveness of such rooms could not be determined because of their demolished condition. Some fuse cabinets were located in separate rooms, while others were in rooms where dust was present.

While some of the electrical equipment did not comply with the code requirements, there was no indication that any of it had failed to function properly or that it had been definitely involved in the explosion. Much of it had been installed for years and complied with the existing rules at that time. Steps had been taken during the past few years to improve conditions, and newer equipment had been properly installed.

Story of the Explosions and Fire.

The main explosion occurred without warning at 4:00 P.M., just one-half hour after shifts were changed at the mill. It was believed to have originated in the basement or first floor of the specialty mill toward the east side. The blast tore out a 50-foot section of the east wall, leaving a gaping hole extending from the ground level to the third floor. Windows were blown out on the fourth floor, but some on the fifth floor were not shattered. Bystanders reported that two lesser explosions followed the first explosion, apparently as the percussion spread to other buildings. Part of the west wall was blown out, and the south wall was left in danger of toppling.



Milwaukee Journal.

The specialty mill and corn mill from the southeast. Firemen are playing hose streams on the ruins of the specialty mill. The east wall of the corn mill (by the freight cars) received the greatest force of the blast.

The force of the explosion wrecked underpinning of the concrete storage tanks across the railroad tracks to the west, causing fear that the tanks might collapse. The entire neighborhood was showered with concrete, stones, and débris. One 500-pound piece of concrete from one of the concrete tanks was blown a distance of 150 feet.

To the south of the specialty mill was a brick and tile shipping shed which was completely demolished. The walls were blown out and the roof collapsed on sacked flour and corn meal. Several men who were loading two trucks in this shed at the time of the blast were injured. Others escaped injury when piled bags broke the fall of the heavy trusses. There was no fire in this building. Large sections of the first and second floors of the corn mill were

broken up, and the building frame was blown outward. Panel walls were forced out as high as the third floor. The building to the north of the corn mill was left intact, except that the roof was shattered by concrete slabs about one inch thick, two feet wide, and 20 feet long, which dropped on it from the corn mill.

Fire that broke out in lower floors of the corn mill and specialty mill burned so fiercely that rescue workers were endangered as they helped remove the injured from the wreckage. Fire also burned severely in the north part of the south warehouse. Fire followed the explosions to the west group of buildings as shown on the map — the most severe burning occurred in the warehouse adjoining the brick tanks, the work house above the steel tanks in the feed mill, and in the south part of the flour paste building. Wooden box cars standing between the two main fire areas did not catch fire.

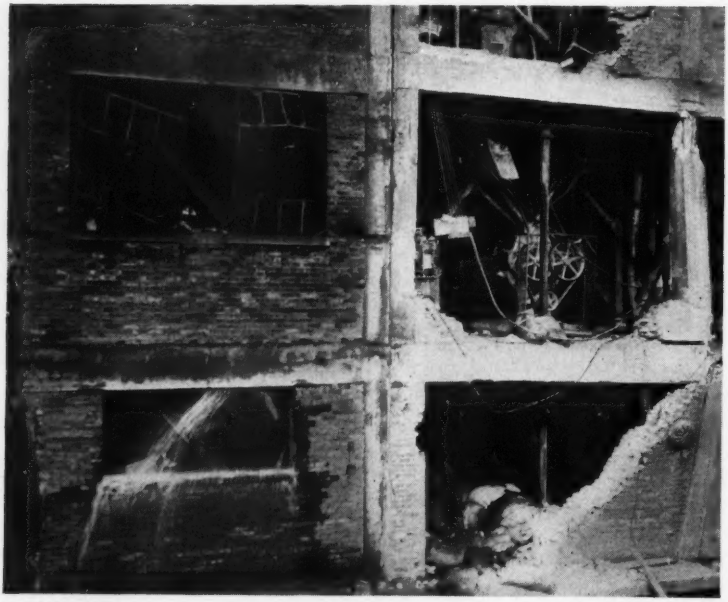
Firemen and policemen from Milwaukee and West Allis were sent with fire trucks and ambulances to help fight the fire, aid the victims, and control the crowds. Seventy-five deputies reported from the county sheriff's office, and West Milwaukee sent its nine policemen. The Milwaukee Fire Department received a call for help at 4:09 P.M., and responded to the mill just outside the Milwaukee city limits with nine engines, three ladder trucks, a rescue squad, and a large number of firemen under command of a deputy chief and two district chiefs. The West Allis Fire Department sent one engine and nine firemen. The combination of flour and water produced a paste which made fire fighting operations difficult in one of the storage sheds. It was several hours before the fire was brought under control.

Sixty men were working in the plant at the time of the blast. By early the next morning, one was dead, two were missing, and the other 57 were accounted for. Injuries and burns finally resulted in the death of nine persons. Twenty-six others were less severely injured or burned, or both. Eight ambulances carried the injured to hospitals.

Apparenty a large number of sprinkler heads fused and controlled the fire in many sections, but no doubt some of the system was wrecked by the explosions before the fire occurred. Ample fire fighting facilities seem to have been provided by Milwaukee and West Allis. While an examination of the map may indicate a shortage of fire hydrants, there seemed to be no shortage of water. The loss of approximately $1,250,000 resulted primarily from the explosions rather than from the fire which followed.

Cause of the Explosion.

The cause of the initial explosion has not definitely been determined by the various investigations now under way. The possibility that the explosion might have been caused by a spark when an employee was replacing an electric fuse in the tunnel between the elevator and the corn mill was suggested by some of the employees.



Milwaukee Journal.

Close-up view of the east side of the corn mill where the greatest damage was done by the explosion. The west walls of this building were bulged.

In addition to finding that electric wiring had been placed in rigid conduit and that lamps had been placed in dust-tight globes in locations where dust might be expected, the report of the preliminary investigation made by the Industrial Commission of Wisconsin indicated that at least some stoners and magnets had been provided to remove foreign substances from the grain, and that "no smoking" signs had been prominently displayed throughout the plant and rigidly enforced. Special cooling equipment had also been used to prevent overheating of bearings. Housekeeping work apparently was done by a crew of employees on each of the three shifts who were assigned to do sweeping and cleaning as a continuous operation on floors and non-moving parts of machines. On about every second Sunday, when the plant was shut down, the walls, ceilings, and moving parts of machines were cleaned. It was reported that the last cleaning took place on Sunday, April 4, 1937, when 28 men were employed for a total of about 170 hours.

This was the second serious explosion and fire in the Krause plant. On September 2, 1924, a dust explosion and fire destroyed a ten-story cereal and feed mill and adjoining structures, causing the loss of one life and damage to the plant estimated at $1,500,000. (See January, 1925, QUARTERLY.)

Omaha Exposition Fire.

Report by Nebraska Inspection Bureau,
(Member N.F.P.A.).

Three men and some 75 valuable race, saddle, and show horses lost their lives in a fire that burned for a little over an hour on June 6, 1937, and did approximately $150,000 worth of damage in the race track property of the Ak-Sar-Ben Exposition Co., Omaha, Nebraska. A monstrous frame barn with an undivided floor area of approximately 80,000 square feet was a total loss. A semi-fire-resistive exposition building, communicating with the stock barn through two unprotected frame passageways, each 40 feet long, was damaged.

The stock barn involved in this fire was used for the housing of 150 valuable horses owned by various tenants and race track men, and was valued at $32,500. Aside from the horses and other property of tenants, the total value of the contents was only about $500, but the value of the horses probably ran well over $200,000. Only half of these could be saved. The exact total loss has not and probably cannot be ascertained.

Story of the Fire.

There were many stable employees, horse owners and visitors in and about the barn on the day of the fire. In all probability, one of them was responsible for the fire when he dropped a lighted cigarette somewhere near the center of the structure and ignited loose hay in one of the stalls. The fire was whipped into energetic action by a strong west wind coming through open windows and doors. When the alarm sounded, immediate confusion ensued. The horse men were all so intent on getting their horses out of the building that no one thought to turn in an alarm to the fire department. Thus there was considerable delay before a special police officer on the outside transmitted the alarm over a telephone box marked "Fire and Police" 100 feet distant from the barn on the side of the exposition building. The telephone was directly connected to the fire and police board in the city telephone exchange.

On his way to the fire, the chief of the first battalion saw, from about two miles off, the column of black smoke and stopped to turn in a second alarm. He went on to the fire to find most of the barn involved.

The two alarms brought six engine and hose companies, two ladder companies, a service truck and a first aid squad car. There were 37 firemen, including chiefs, at the fire. Only three of the six pumpers could be put into operation on the fire because of a very limited water supply. The only supply to the exposition grounds was one long lead of 6-inch and 8-inch main having a dead end. It was evident at the outset that the nine hose streams from three

Acme.

This Omaha race track stock barn, 80,000 square feet undivided area of frame construction, full of hay and other highly combustible contents, was not equipped with sprinklers or any other adequate fire protection. As a result of a delayed alarm, it was hopelessly involved before hose streams could be put into action. Three men and seventy-five horses were burned to death in the fire.

1000-gallon pumpers and two hose streams directly from hydrants could have little effect on a structure so completely combustible in construction and contents. If the high wind that was blowing had not been in the west, firemen would probably have had serious trouble in saving the semi-fire-resistive exposition building to the west of the barn. The fire was considered out, mainly through its own efforts, at 3:30 P.M., just an hour and nine minutes after the delayed first alarm. So complete was the destruction that very little wrecking had to be done to remove all trace of a building of any kind.

Loss of Life.

In the midst of the confusion where tenants were trying whole heartedly but half headedly to save their beautiful horses, two stable employees lost their way and were trapped and burned to death in the barn. Another who escaped too late succumbed a few days later. The horses died helplessly terrified. Horses do not understand fire. In the midst of the knowledge that something terrible is going on around them, they remember that their stalls have always protected them from harm. The seventy-five horses that were saved had to be led out by force. Half a dozen actually turned and ran back

into the fire after being liberated. Many more might have been saved had it been necessary merely to open the stalls and let the creatures find their own way to safety.

The factor which contributed perhaps more than any other to the severity of this fire was the large undivided combustible area through which the fire could spread unimpeded. This resulted in the barn being almost completely involved before protection could be brought up, and also, by that time, in a serious exposure hazard, even against the wind, to the buildings on the west side. Fortunately there were no adjacent buildings to the east.

This fire, with its estimated $150,000 practical loss, will not be the largest loss fire of 1937, but to many of the horse owners and to the friends of the stable employees who lost their lives, the intangible loss will reach beyond all figures.

Hotel Loch Arbour Fire.

Fire starting at one o'clock on the morning of May 17, 1937, and burning for four hours, completely destroyed the Hotel Loch Arbour at Allenhurst, N. J. The fire started in the lobby, possibly from defective wiring, and was discovered by several persons about the same time, who claimed that they heard an explosion and then saw the entire front of the hotel burst into flames. The total loss was $150,000. (See Frontispiece.)

This was a seasonal resort hotel and was not in operation at the time of the fire. It was a 5-story frame and brick structure, with a flat and peaked composition roof. On the first floor were a smoking room, pool room, barber shop, employees' quarters, laundry, and grocery storeroom. On the second floor were the lobby, office, ballroom, dining room, and kitchen. The other three floors consisted of guest rooms. The hotel had just been completely redecorated, and the painters had cleaned up and left the hotel on the afternoon before the fire.

The Allenhurst Fire Department was notified by telephone at 1:14 A.M. and upon arrival called the Asbury Park and Deal departments. The Wanamassa and Oakhurst departments were then notified, and when it appeared that the fire would get beyond control a general alarm was broadcast from the county police radio station. This brought fire apparatus from as far north as Highlands and as far south as Manasquan — an area twenty miles long.

Firemen were at first hampered by the lack of water, as only about 850 gallons per minute were available from the hydrants in the vicinity of the

NOTE: This account has been prepared from a report furnished by R. M. Cadman, Superintendent, Engineering Department, Schedule Rating Office of New Jersey.

International.

Complete destruction of the 5-story Hotel Loch Arbour at Allenhurst, N. J., by a fire on May 17, 1937. Flaming embers from the fire started many roof fires in the vicinity, one of which was four blocks distant.

hotel. The pumpers then took suction from Deal Lake, which was across the street in front of the hotel. At the height of the fire, thirteen engines were operating. In addition to the hotel, the 3-story frame annex to one side was about half destroyed, and four frame garages in the rear of the hotel were completely destroyed.

Flying embers blown by a strong southeast wind ignited the roofs of many houses northwest of the hotel, but firemen with hand extinguishers controlled these fires as fast as they started. At least ten roof fires were burning at one time. While it was not possible to save the hotel, the quick concentration of 21 fire companies, most of which were volunteer, prevented a sweeping conflagration.

If the fire had occurred two weeks earlier, firemen would have been almost helpless to prevent its spread. At that time Deal Lake had been drained to permit the construction of a sewage disposal plant, and water from the hydrants would not have been anywhere near adequate. Had the fire occurred two weeks or more later when the hotel would have been occupied, it appears likely that some lives might have been lost because of the rapidity with which the building burned.

Laurier Garage Explosions, Montreal.

Three firemen were killed and more than 100 other persons were injured in Montreal, Quebec, on June 25, 1937, when five explosions of gasoline vapors wrecked a six-story garage. Christopher Carson, Chief of the Montreal Fire Department, was seriously injured with a fractured skull and for several days was not expected to live; later reports, however, state that he now has a good chance to recover. The loss to the building was estimated at $75,000, with probably an equal loss to the contents and near-by property. Details relative to the installation of the storage tanks, methods of venting and filling them, how the vapor escaped and how it was ignited are not definitely known, as the investigation now under way has not been completed.

The garage is six stories high and of fire-resistive construction. The walls and floors resisted the blasts except that much of the front wall was blown out. The building is owned by the Title Guarantee and Trust Corporation. Automobiles were stored on nearly every floor. The garage is located on Laurier Avenue, between Hutchinson Street and Park Avenue.

The first explosion occurred at 1:25 P.M. It shattered glass in the building and brought forth a belch of flames. Five minutes later, just after the firemen had arrived and started to work, a second explosion followed, but did not cause much damage. The third explosion, which came at 2:00 P.M., did the most damage, killing the three firemen and injuring the chief, thirty-four firemen and scores of shoppers in the district. Nearly every person standing within the block was knocked down. When the third explosion occurred, firemen were pouring water into the basement from several hose lines. The fire was confined to the basement and was believed to be under control when the sudden crash and burst of flame came. The fourth explosion occurred at 5:20 P.M. At 1:50 the next morning, the fifth and last explosion rocked the building and set fire to the entire second floor, from which flames had previously been barred by the thick concrete floor.

Firemen used every means available to combat the flames. Cellar nozzles were very effective in getting large streams of water into the basement. The reddish hue of the flames indicated clearly that they were fed by gasoline. Apparently the fire department had no foam or other special extinguishing equipment with which to fight flammable liquid fires. It was a difficult situation for the firemen, as the cellar was filled with water. They were ordered not to throw water directly on the flames fed by gasoline as this would do more harm than good. The burning gasoline floating on top of the water threatened to spread the fire to other property. By 8:30 P.M. the flames had eaten through the ground floor and two of the three gasoline tanks had exploded.

International.

The Laurier Garage in Montreal in which five gasoline vapor explosions occurred on June 25, 1937, killing three firemen and injuring over one hundred others.

The added danger of sewer explosions further complicated the problem. Streets were blocked off in the danger zone, as tests indicated that gas in the sewers was of explosive content. By 2:00 A.M. the sewers were reported to be safe and by 7:00 A.M. every drop of gasoline had been burned (because of the lack of proper equipment for fighting this fire, the firemen were obliged to let the fire burn itself out).

It is reported that there were three gasoline storage tanks, two of 1000 gallons capacity each and one of 500 gallons capacity. One apparently was buried underground and was not a factor in the explosion. The other two were openly exposed in a pit underneath a concrete floor. Whether there was an opening between the pit and the garage basement is not known, and neither is it known whether the first explosion occurred in the pit and made an opening into the basement, or whether the fumes first seeped into the basement and exploded there. It appears that in filling one of the tanks, gasoline overflowed into the pit around the two tanks, filling the space with gasoline vapors. The source of the ignition has not been determined.

A year ago the Canadian Underwriters' Association conducted a survey of the fire hazards in Montreal and reported that comprehensive flammable liquid regulations were urgently needed. The Dominion Fire Prevention Association and the Association of Canadian Fire Marshals then drafted a model law which effected the regulations requested by the underwriters. This law, however, was not adopted.

Fire Record of Dairies and Creameries.

The dairy industry is one of the largest and most vital farming industries. According to the *Dairy Industries Catalog File* the United States per capita consumption of cow milk products in the year 1934 was 92.6 gallons. The milk produced in the United States for that year by a total of 24,581,669 dairy cows exceeded ten and one-half billion gallons.

The figures for other dairy products in the year 1935 as given in the *Statistical Abstract of the United States, 1936* are: creamery butter, 1,632-380,000 lbs., cheese, 730,535,000 lbs., evaporated, condensed and dry milk, 2,821,700,000 lbs., and ice cream, 199,385,000 gal.

The fires included in this record occurred in creameries, including dairies and milk stations, cheese factories, and powdered milk plants. Creameries are engaged in pasteurizing and separating whole milk, selling milk and cream, making butter, and in some cases ice cream. In this occupancy the common hazards predominate. Some large creameries do some evaporating. This is generally done in steam-heated kettles and involves little additional hazard if the steam piping is properly installed.

In cheese factories the milk is soured, and the curd separated from the whey. Cheese is made from the curd by pressing, moulding and flavoring. The flavoring sometimes involves cooking, introducing the hazards of gas, steam, or coal fired kettles. This and a small power plant are the only special hazards of cheese factories. There seems to be, however, a peculiarly large moral hazard, which, together with the remoteness of small cheese factories from fire protection, results in a rather unfavorable record.

Milk powdering plants operate in one of two different ways. Some plants apply the milk to heated rollers and scrape off the film that is left when dry. This film is pulverized. The other method is to spray the milk in a hot air heated room. This process is the more hazardous, since dust deposits may accumulate in the drier and be ignited by the heat. If this occurs there is a serious dust explosion hazard. A new development in the spraying method is the conical drier which rotates and prevents accumulation.

There is not in any of these processes and occupancies a special hazard that results in many fires annually. It is carelessness incidental to the particular plant that is responsible in most cases.

The following table of the causes of the 102 fires in dairies and creameries with reports on file with the N.F.P.A. Department of Fire Record shows the wide variance of hazards found in this occupancy. Only thirteen may be termed special hazard causes. The leading known cause is defective wiring, although responsible for only eight fires.

Causes of Dairy Fires.

I.	Careless Housekeeping		7
	Spontaneous ignition of waste material	4	
	Spark from boiler igniting waste material	1	
	Careless disposal of hot ashes	1	
	Miscellaneous carelessness with rubbish	1	
II.	Special Hazard Causes		13
	Tar used for laying new floors and walls ignited	4	
	Dust explosion of powdered milk	2	
	Ammonia fumes ignited from oil burner	1	
	Explosion of ammonia condenser	1	
	Other explosions in refrigerating plant	1	
	Spontaneous ignition of ground cork	1	
	Paraffin boiled over on gas plate	1	
	Ignition of cork	1	
	Overheated drying room	1	
III.	Heating and Cooking		13
	Overheated or defective flue or chimney	4	
	Spark from boiler	3	
	Overheated stove	2	
	Heater placed too near wall	1	
	Overheated boiler	1	
	Back flash from boiler	1	
	Kerosene stove	1	
IV.	Electrical Causes		10
	Defective wiring	8	
	Short circuit in motor or switch	2	
V.	Miscellaneous Known Causes		27
	Smoking and matches	6	
	Spontaneous ignition of coal	3	
	Incendiary	3	
	Spontaneous ignition of hay	2	
	Sparks on wooden shingle roof	2	
	Careless handling of gasoline	2	
	Spark from floor waxing machine	1	
	Spark from tractor	1	
	Dust explosion in feed mill	1	
	Spark from acetylene torch	1	
	Spark from locomotive	1	
	Lightning	1	
	Explosion of gasoline engine	1	
	Ignition of lacquer from open flame	1	
	Children playing with matches	1	
VI.	Unknown		32
	In boiler or engine room	9	
	In other section of plant	18	
	In unknown section of plant	5	
	Total		102

Dairy Fire Losses.

The loss record of the 102 dairy fires with reports on file with the N.F.P.A. Department of Fire Record is indicative of the fact that the concentration of values in this occupancy is sufficient to result in large losses. The loss record in sprinklered plants is as usual far more favorable than in others. The Department of Fire Record has as yet no report of a sprinkler failure in the dairy industry. The following table is not a complete statistical record, but summarizes the fires from which the cause table was derived.

Loss Record of Dairy Fires.

Loss	Sprinklered	Not Sprinklered	Total
Less than $1,000	14	9	23
$1,000 to $9,999	3	18	21
$10,000 to $49,999	0	27	27
$50,000 to $99,999	0	17	17
$100,000 or over	0	5	5
Large loss, no specific data	1	4	5
Total loss, no specific data	0	2	2
No data	0	2	2
Totals	18	84	102

Point of Origin of Dairy Fires.

Since dairy fires cannot readily be broken down into general hazard classes, a study of the point of origin of the fires is interesting. It may lead to an understanding of the locations where the most care must be used in maintaining cleanliness and enforcing strict fire regulations.

Boiler room	21
Hay or cow barn	13
Roof	6
Mechanical refrigeration section	5
Milk powdering and drying	5
Engine room	5
Office	4
Storage room	4
Coal pile	3
Outside of buildings	3
Garage	2
Ice house	2
Dairy laboratory	2
Packing room	2
Miscellaneous known locations	15
Unknown locations	10
Total	102

Dairy Fires in Wisconsin.

Wisconsin is by far the leading state in the dairy industry. Its cheese factories, of which there are 2625 more than there are in the rest of the United States and Canada combined, produced 333,206,000 pounds of cheese in 1934. This is 57.5% of the entire United States production. Besides this commanding lead in the cheese industry Wisconsin produces 9.6% of the butter, and 32.9% of all the evaporated, condensed and dry milk manufactured in the United States. To protect this vast industry in time of depression, the Wisconsin legislature passed in 1935 a law which states, "Every person, firm or corporation duly licensed to operate a hotel or restaurant shall serve with each meal for which a charge of twenty-five cents or more is made, at least two-thirds of an ounce of Wisconsin butter and two-thirds of an ounce of Wisconsin cheese."

The following table compiled from state fire marshals' reports shows the fire loss in the dairy industry in Wisconsin for ten years. Based on these

figures an estimate has been made by the N.F.P.A. Department of Fire Record that there is a $200,000 loss annually in 40 cheese factory fires, averaging $5000 per fire, and losses amounting to $650,000 annually in 150 fires in the entire dairy industry, averaging $4300 per fire. This estimate is based on the experience in and number of the plants in Wisconsin, assuming that they represent a typical cross-section of the dairy industry.

Four states besides Wisconsin classify creameries separately in their fire marshals' reports. Iowa had seven fires in 1936, with a loss of $2741, Indiana had one in 1935 with a loss of $500, Washington had two fires in 1935 with a loss of $3062, and the South Dakota fire record included one cream station fire, involving a $25 loss.

Wisconsin Dairy Fires, Ten Years.

Year	Cheese Factories		Creameries		Milk House or Dairy Plants		Totals	
	Fires	Loss	Fires	Loss	Fires	Loss	Fires	Loss
1925.....	23	$144,720	3	$10,300	..	.....	26	$155,020
1926.....	23	135,310	7	32,480	..	.....	30	167,790
1927.....	13	113,130	7	27,440	7	3,255	27	143,825
1928.....	21	134,200	3	17,035	3	2,300	27	153,535
1929.....	22	143,410	3	21,300	5	1,725	30	166,435
1930.....	21	138,236	5	29,459	5	1,950	31	169,645
1931.....	13	93,735	2	22,550	5	1,266	20	117,551
1932.....	19	88,249	5	8,495	3	962	27	97,706
1933.....	33	71,346	11	48,948	6	4,127	50	124,421
1934.....	No Report							
1935.....	18	38,255	11	2,334	18	22,705	47	63,294
	206	$1,100,591	57	$220,341	52	$38,290	315	$1,359,222

Dairy Fires in British Columbia.

From reports of the Fire Marshal of British Columbia, the following twelve-year record was compiled. It is intended to give an example of dairy loss experience in Canada where the different climate and working conditions may result in a different type of record.

Dairy Fire Record — Province of British Columbia.
1924-1935 Inclusive.

	No. of Fires	Loss
Sparks from chimney	6	$2,099
Short circuit	3	1,141
Exposure	2	417
Hot ashes	2	105
Smoker	2	189
Static electricity	1	117
Electric appliances	1	103
Defective motor	1	85
Overheated bearing	1	70
Spontaneous ignition	1	59
Overheated motor	1	15
Total known causes	21	$4,400
Unknown causes	4	20,032
Total	25	$24,432

Ruins of the spray drying room of a powdered milk plant after a violent milk dust explosion, which seriously injured two employees and caused $25,000 damage.

Typical Special Hazard Fires.

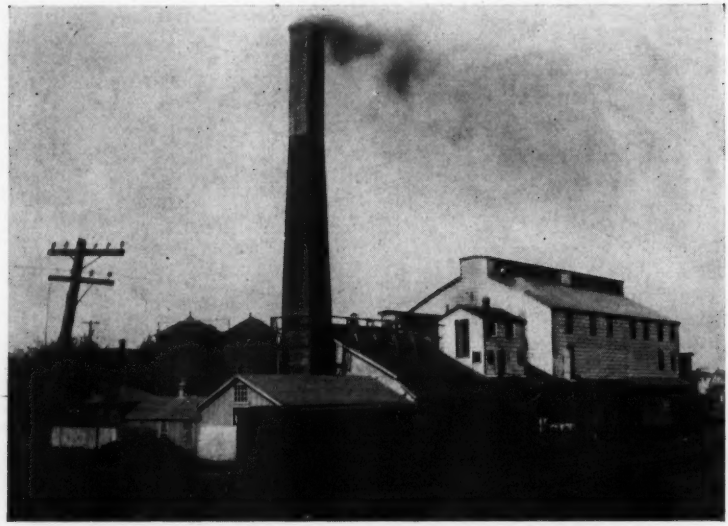
The greatest number of special hazard fires reported to the N.F.P.A. were caused by the ignition of tar being used to lay floors or walls, chiefly in the refrigeration section of the plant.

TACOMA, WASH., MARCH 4, 1926. Cork sheets for lining the wall of the refrigerating room of a creamery and cold storage plant were being dipped in a vat of boiling tar before application. Vapor from the tar was ignited from the gas heater after much of it had been spilled on the floor. There was a $50,000 loss before the fire was extinguished. (H-23221.)

Dust Explosions in Powdered Milk Plants.

Two dust explosions in powdered milk plants have been reported to the Department of Fire Record. These are very interesting because they show that the explosion of milk dust is a hazard not materially different from that of any other dust.

VALDERS, WIS., OCT. 1, 1923. The operator in charge of the plant at night noticed a bright light in the drying chamber reflected through the glass covered peephole. About five minutes later, after the operator had gone for a fire extinguisher, drawn off the milk powder from the bottom of the drier, shut off the air fan, and shaken down the dust adhering to the screen, the explosion occurred. The operator who was coming up the stairs at the time was blown back down and out an exit, but was uninjured. A watchman who



A dry milk plant in Courtland, Ont., before being demolished by a dust explosion and fire, on May 19, 1932. (See next picture.)

was the only other person in the plant and was watching the fire in the dryer, was blown back through the room about twenty-five feet and his clothing ignited. He made his way through the wreckage and flames to a tank of water and crawled in to extinguish the fire in his clothing. Afterwards he got out of the building through a window.

The shaking down of the dust was undoubtedly the cause of this explosion, as the fan was stopped and dust was therefore allowed to rest in suspension over the fire. The damage to the plant was about $25,000. (H-21548.)

COURTLAND, ONT., MAY 19, 1932. In a plant where milk was atomized and powdered in contact with an up-draft of warm air, the operator had just completed the atomizing process and had entered the chamber to remove powder accumulations on the walls and louver screens by striking them with a stick. As he did so a sheet of blue flame suddenly seemed to envelope the whole interior of the box. The operator ran for the door of the box, and as he opened it an explosion occurred, followed shortly by another explosion in the second powder box located in another room. The employee escaped from the building, but was so terribly burned that he lived only three hours.

It is probable that the first flash stirred up a large amount of powder, which was later ignited, resulting in a typical double dust explosion. The loss was estimated at over $31,000. (H-35347.)

View of the opposite end of the Courtland plant after the disastrous fire in which one employee was burned to death.

Refrigerating Equipment.

Three of the fires reported to the Department of Fire Record were caused by defective refrigerating equipment.

SOMERVILLE, MASS., OCT. 31, 1928. A leak in the ammonia refrigerating system allowed an explosive mixture of the gas to accumulate in the basement of a creamery. The explosion was touched off by the oil burner, and the fire that followed spread rapidly through the building, causing $75,000 damage. (H-26785.)

Typical Common Hazard Fires.

The following fires are typical examples of the many common hazards contributing to the dairy fire record.

SEPT. 6, 1914, COOPERSTOWN, N. Y. An accumulation of rubbish in the boiler room, about two feet from the boiler and against the wall, was ignited. The fire spread to the woodwork, causing damage of $4000. (H-11215.)

JAN. 29, 1917, BUFFALO, N. Y. In the chemical laboratory of a dairy the heat from a small gas fired sterilizing oven caused sufficient expansion in a quart of amylacetate bronzing lacquer to burst the can. The gas flame ignited the flammable vapors and caused a mild explosion and fire that did $35 damage. (H-12783.)

FEB. 20, 1922, WAGARVILLE, MICH. A spark from the chimney ignited the roof of a wooden creamery, general store and dwelling. Since the building was remote from any fire protection it was a total loss. (H-18335.)

AUG. 5, 1922, WHITE LAKE, S. D. A creamery plant valued at $11,500 was a total loss when coal that had been stored in the bin the preceding day ignited spontaneously. (H-18805.)

JAN. 2, 1923, ANTIGO, WIS. A cheese factory valued at $8800 burned to the ground when a defective chimney started a fire in the attic. No fire protection was available due to the remote location of the plant. (H-19266.)

JULY 1, 1926, NEW YORK, N. Y. Nine separate incendiary fires were started in a plant manufacturing malted milk. Twenty-six sprinklers operated and practically extinguished the fires with moderate loss. (S-42728.)

FALL OF 1928, NEWARK, N. J. The office floor of a milk depot was being waxed and a spark from the waxing machine or heat caused by friction ignited the wax. The fire spread along the floor to wooden partitions. It was confined to the office room with a loss of $500. (H-29109.)

JUNE 27, 1929, WATERLOO, NEB. Lightning struck a milk powdering plant that was remote from fire protection and started a fire that destroyed the entire plant with a loss of $100,000. (H-27986.)

JULY 9, 1929, NORTH BEVERLY, MASS. Spontaneous combustion in a mow of new hay started a fire that destroyed a hay barn, cow barn and dairy house, with a loss of $66,280. Workmen were removing the hay to determine the cause of smoke that was filtering through when the fire suddenly broke out. (H-27820.)

DEC. 4, 1932, SYCAMORE, ILL. Fire started in grass and weeds surrounding a dairy plant and spread to the building. Although the fire department was called before the building was involved, they were made powerless by an inadequate water supply, and the plant was destroyed. It is thought that locomotive sparks ignited the grass. (H-36278.)

NOV. 7, 1933, JELLICO, TENN. An overheated stove in the bottling room of a grocery and milk station ignited the woodwork of the building. The fire was extinguished only after a $5000 loss. (H-37695.)

JUNE 28, 1934, TORONTO, ONT. A spark from the chimney of a dairy plant ignited the woodwork around a roof hatch. It burned through to the inside and opened one sprinkler, which held the fire in check. The loss was $515. (S-67183.)

JULY 19, 1936, SOMERVILLE, MASS. Children entered a dairy garage and, probably by playing with matches, set fire to the seat cushions of a truck. Damage was confined to the cab of the truck, and amounted to about $100. (S-72216.)

MAY 19, 1937, O'NEILL, NEBRASKA. Two men working in a creamery found a fire burning in the engine room. They called the fire department and then tried to fight the fire with hand extinguishers. Although the department responded promptly, the fire had spread with such rapidity that the building was severely damaged. The loss was $34,000. (H-41771.)

Fires in Which There Was Loss of Life.

Second Quarter, 1937.

Since the publication of the April QUARTERLY, the N.F.P.A. Department of Fire Record has received from various sources 200 reports of fires in which there was loss of life. A total of 351 lives were lost in these fires. During the period the following fires were reported in the United States and Canada, which caused the loss of more than five lives each.

APRIL 5, 1937, PORT ALLEGANY, PA. Six children were trapped and burned to death in the second floor bedrooms of a rural dwelling, when a night fire seriously involved the house before being discovered. The parents were badly burned making their escape. (L-4034.)

APRIL 10, 1937, MILWAUKEE, WIS. Nine men were killed in a series of violent dust explosions in a grain elevator. (See page 59, this QUARTERLY.)

MAY 5, 1937, SPRINGHILL JUNCTION, N. S. Seven men were crushed and burned to death when a string of runaway coal cars coming down a grade collided with a crack express train going up, and flammable materials in the baggage cars burst into flame. The bodies of the dead were burned beyond recognition. (H-41773.)

MAY 6, 1937, LAKEHURST, N. J. In the fire that destroyed the German Zeppelin "Hindenburg," 33 men, 2 women, and a child were burned to death. (See page 53, this QUARTERLY.)

International.

Three men and two women were burned to death when this automobile and truck collided at Santa Ana canyon, California, on March 12, 1937. (H-41783.)

MAY 26, 1937, COXSACKIE, N. Y. A convertible coupé, carrying six men, crashed into a truck laden with linseed oil and paint. The truck burst into flame, igniting the coupé, and burning to death the truck driver, his helper, and four of the passengers in the automobile. (H-41779.)

MAY 30, 1937, CRISFIELD, MD. Fire in a strawberry pickers' shanty where people were packed together like cattle, burned to death eight negroes all of one family. Several others escaped by jumping from second story windows. (L-4035.)

JUNE 4, 1937, SHILOAH SPRINGS, CAL. Seven people were burned to death in a cross country bus when it swerved off the road, overturned, and immediately caught fire. One of the 50-gallon tanks of gasoline, that had been broken open by the crash, fed the flames. (H-41774.)

Two outstanding loss of life fires outside the United States and Canada have been reported during the past three months. While these are not included in the tables, they are of sufficient interest to be summarized here.

Loss of Life Fires, April-June, 1937.*

This is a typical rather than a complete record, presented to show the conditions under which loss of life occurs, that they may be known and guarded against. The total loss of life by fire in the United States is estimated at 10,000 annually.

	Fires	Men	Women	Children	No Data	Total
Airplane fires	2	2	0	0	4	6
Zeppelin	1	33	2	1	0	36
Apartments, hotels, tenements, etc.	14	8	7	3	0	18
Automobiles, buses, trucks	10	27	2	0	1	30
Gasoline tank trucks	3	6	0	0	0	6
Automobile trailers	1	0	1	1	0	2
Barns and stables	5	6	0	3	0	9
Barracks	1	1	0	0	0	1
Boats and ships (including house boats)	1	1	0	0	0	1
Conflagrations	2	3	1	0	0	4
Dwellings—Rural	59	27	22	43	4	96
Dwellings—Urban	56	15	30	17	2	64
Forest or brush fires	3	5	0	0	0	5
Garages	2	4	0	0	0	4
Gasoline filling stations	1	1	0	0	0	1
Gas works	1	1	0	0	0	1
Grain elevators	2	10	0	0	0	10
Hospitals	1	1	0	0	0	1
Manufacturing occupancies, misc.	4	5	1	0	0	6
Mercantile occupancies, misc.	5	5	1	1	0	7
Mining property	3	9	0	0	0	9
Oil refineries	2	3	0	0	0	3
Out of doors	9	3	0	7	0	10
Railroad rolling stock	1	7	0	0	0	7
Response to alarms	4	5	0	0	0	5
Schools	1	1	0	0	0	1
Tank vessels	2	2	0	0	0	2
Miscellaneous known buildings	4	4	1	1	0	6
Totals	200	195	68	77	11	351

*This table is made up from those reports received by the Department of Fire Record between April 1, 1937, and June 30, 1937. A few of the fires included herein occurred prior to April 1, but were not reported until subsequent to that date.

Causes of Loss of Life, April-June, 1937.

Fatalities classified according to the immediate cause of the loss of life rather than according to the cause of the fire.

	Men	Women	Children	No Data	Totals
Airplane fires	2	0	0	4	6
Zeppelin	33	2	1	0	36
Automobiles, buses, trucks	27	2	0	1	30
Gasoline tank trucks	6	0	0	0	6
Boats and ships (including house boats)	1	0	0	0	1
Children alone in house	0	0	14	0	14
Children playing with matches	0	0	6	0	6
Clothing ignited:					
Bonfire	0	0	2	0	2
Fireplace	0	2	0	0	2
Furnace, stove, or heater	3	14	3	0	20
Smoking (see also smoking in bed)	3	1	0	0	4
Miscellaneous or unknown cause	2	3	0	0	5
Conflagrations	3	1	0	0	4
Entering or re-entering burning buildings	0	2	0	0	2
Escaping fires—jumped or fell	0	2	0	0	2
Explosions (miscellaneous):					
Acetylene	2	0	0	0	2
Anesthetic in lungs	1	0	0	0	1
City gas	1	4	0	0	5
Dynamite	2	0	1	0	3
Dust explosions	10	0	0	0	10
Gas works	1	0	0	0	1
Manhole explosion	1	0	0	0	1
Miscellaneous or unknown	2	0	0	0	2
Fire fighting—firemen	6	0	0	0	6
Flammable liquids and vapors:					
Burning anthills with gasoline	0	0	1	0	1
Heating gasoline on stove	0	1	1	0	2
Home dry cleaning	0	3	0	0	3
Lacquer or paint	1	0	0	0	1
Oil drum	1	0	0	0	1
Oil refinery	3	0	0	0	3
Oil stove, furnace, or lamp	1	1	1	0	3
Starting fires with gasoline	1	0	0	0	1
Starting fires with kerosene	8	11	3	0	22
Tank vessels	2	0	0	0	2
Tar barrel	0	0	1	0	1
Miscellaneous cleaning with gasoline	1	2	0	0	3
Miscellaneous gasoline explosions	3	2	2	0	7
Miscellaneous kerosene explosions	0	1	0	0	1
Forest or brush fires (including fire fighting)	4	0	0	0	4
Mine fires and explosions	9	0	0	0	9
Overcome by smoke—suffocation	3	2	2	0	7
Railroad fires	7	0	0	0	7
Shock from fire	4	0	0	0	4
Smoking in bed	4	1	0	0	5
Traffic accidents (fire apparatus)	5	0	0	0	5
Trapped in burning buildings	30	10	35	5	80
Trapped in incendiary fires	1	0	4	0	5
Trapped in lightning fire	1	1	0	0	2
No data	0	0	0	1	1
Totals	195	68	77	11	351

APRIL 20, 1937, KILINGI, ESTONIA. One hundred children were assembled in a schoolroom to witness the showing of some motion pictures, when a flash fire occurred in seven rolls of old film. The projector was near the door, making escape difficult. Twelve of the children were fatally burned. The films involved in the fire were of the highly flammable nitrocellulose type and over ten years old.

MAY 5, 1937, EL BAKATUSH, EGYPT. Twelve persons were burned to death in a conflagration that destroyed 385 homes.

Typical Loss of Life Fires.

Gasoline Tank Truck.

MARCH 27, 1937, WINFIELD, KAN. Two men were trapped in the cab of a heavily loaded gasoline tank truck when the machine overturned and burst into flames. They were fatally burned. (H-41781.)

Automobile Trailer.

MARCH 14, 1937, PARIS, ARK. Fire which occurred in a trailer resulting from the explosion of a gasoline and paraffin mixture on the stove, trapped and burned to death a mother and her six-year-old daughter, and completely demolished the trailer. (L-4036.)

Children Alone in House.

MAY 11, 1937, OAKLAND, CAL. Fire supposed to have resulted from a cigarette dropped by their mother before going out caused enough smoke and heat to overcome and fatally burn three sleeping children, although the fire never reached their room. The ambulance, rushing the children to the hospital for possible resuscitation, collided with an automobile and overturned, injuring several of the crew. (L-4019.)

Anesthetic Explosion.

JUNE 1, 1937, BALTIMORE, MD. A patient was undergoing a cautery operation on his neck under an anesthetic, consisting of oxygen, nitrous oxide, and ether. An explosive mixture of these gases with air was ignited in the patient's lungs by the electric cautery machine. The explosion killed him instantly. (H-41778.)

Acetylene Gas Explosions.

APRIL 14, 1937, APPONAUG, R. I. Two boys exploring an old tunnel leading from a barn cellar were caught by an acetylene explosion when one of them lit a match. An acetylene lighting system had been employed for the attached dwelling, and although it had been abandoned for several years, all the gas had not been dissipated, and an explosive mixture existed in the tunnel. One of the boys died from his burns. (L-4020.)

MAY 29, 1937, ST. ISIDORE DE PRESCOTT, ONT. In the basement of a garage, acetylene welding equipment was being used on the frame of a car. Some of the gas escaped, perhaps from a damaged hose, and, when explosive

concentration was reached, the cement building was demolished. One of the employees died from injuries caused by falling débris. Three others were seriously injured. (H-41777.)

Clothing Ignited.

DEC. 29, 1936, SELMA, ALA. Another woman died recently from burns received in the cotton dress conflagration at a country club in Selma, bringing the total number of deaths to seven. (See April QUARTERLY, page 384.)

FEB. 16, 1937, HASTINGS, NEB. A woman was fatally burned in the greenhouse where she lived, when a small heating stove ignited her bedding. (L-4021.)

MARCH 31, 1937, WHITE PLAINS, N. Y. A man was lighting a small stove in a shack at the rear of his house, when a piece of burning paper fell out and ignited his trousers. The flames enveloped his legs before he could beat them out, and he eventually died from his burns. (L-4022.)

APRIL 5, 1937, BUFFALO, N. Y. A little girl playing in the kitchen of her home came too close to a gas stove, and her cotton dress was ignited. She was fatally burned. (L-4023.)

Insect Killing by Gasoline Flame.

JUNE, 7, 1937, GOTHENBURG, NEB. A seven-year-old boy was burning anthills with gasoline. The can of gasoline ignited and set fire to his clothing, burning him fatally. (L-4024.)

JUNE 8, 1937, BATAVIA, N. Y. A farmer was burning tent caterpillars with a gasoline blow torch when he ignited a near-by gasoline container. He was burned to death in the explosion and fire. (L-4025.)

Tank Vessels.

APRIL 2, 1937, NORFOLK, VA. An explosion wrecked and sank a 33-ton fueling tanker, killing its master and burning another seaman. (H-41775.)

MAY 24, 1937, at sea off POINTE VICENTE, CAL. Fire which started in the pump room of an oil tanker and fish reduction boat trapped and burned to death a crew member before being extinguished. (H-41776.)

Response to Alarms.

APRIL 17, 1937, WEST PHILADELPHIA, PA. A fire engine collided with a fire patrol truck, killing the fire engine driver, and seriously injuring three other firemen and two bystanders. (L-4026.)

MAY 15, 1937, KINGSTON, N. Y. Two firemen were fatally injured when a fire truck was demolished on a railroad crossing by a passenger train. The firemen were returning from a fire through a blinding rain storm. (L-4027.)

MAY 25, 1937, BOSTON, MASS. A chief's car speeding to an automobile fire struck and fatally injured an aged man who was crossing the street. (L-4028.)

Fire Fighting — Firemen.

JUNE 25, 1937, MONTREAL, P. Q. While firemen were fighting a fire in a six-story garage building a series of gasoline explosions occurred. Three of the firemen were killed, and about a hundred people were injured. (See p. 71.)

Overcome by Smoke — Suffocation.

MAY 13, 1937, NEW YORK, N. Y. A mother and a son living in a second floor apartment were trying to escape from a fire, but were overcome by smoke before they could reach the stairway. They died of suffocation and burns. (L-4033.)

Starting Fires with Kerosene.

JAN. 7, 1937, COLUMBIA CITY, IND. A man was lighting a kitchen stove while holding a can of kerosene in one hand. He and a little girl were burned to death when the can exploded. (L-4029.)

Children Trapped in Burning Buildings.

APRIL 2, 1937, BARNESVILLE, MD. Five rural children were trapped in upstairs rooms and burned to death when a fire destroyed their two story log house. (L-4030.)

MAY 4, 1937, ST. GEORGE, P. Q. Two children were burned to death in a fire which occurred in their farmhouse while the family was asleep. They were trapped when they awakened. (L-4031.)

MAY 10, 1937, STE. MARGUERITE, P. Q. Three children were trapped and burned to death in a barn fire thought to have been started by a short circuit in the electric wiring. (L-4031.)

Trapped in Lightning Fire.

MAY 9, 1937, WASHINGTON, D. C. An urban dwelling was struck and ignited by lightning. Two members of the family were trapped and burned to death in the rapidly spreading fire. (L-4032.)